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Proposed Draft Military Handbook Presenting Requirements for an Electronic Display System (EDS) for Interactive Electronic Technical Manuals (IETMs)

by
Eric L. Jorgensen
Joseph J. Fuller
and
Samuel C. Rainey (Scientific Management Associates, Inc.)

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Jorgensen, Eric L. (DTRC), Rainey, Samuel C. (SMA), and Fuller, Joseph J. (DTRC)

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The report summarizes recent activities in the Department of Defense and in the US Navy, Army, and Air Force to establish Service use Interactive Electronic Manuals (IETMs) as replacements for paper Technical Manuals for logistic support of military equipment.

The IETM concept is described, and an overview is provided of five IETM acquisition Specifications and Military Handbooks developed be Tri–Service Interactive Electronic Technical Manual Working Group established in 1989 by the Defense Quality and Standardization Of-...

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A copy of MIL–HDBK–EDS (Navy) is included in this report as the Appendix.

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CONTENTS

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an Appendix.

ADMINISTRATIVE INFORMATION

ACKNOWLEDGEMENTS

1.0 INTRODUCTION

1.1 BACKGROUND

During the 1980s, it became increasingly apparent that the striking increases in the complexity and sophistication of the weapon systems of all three Services were causing a serious lag in the production, distribution, and management of the Technical Information required to maintain, operate, and support these systems. Of particular concern were increasing weight and space requirements resulting from the increasing bulk of the required paper Technical Manuals.

At the same time, a number of significant technological improvements were being made in the field of information handling, particularly the advent of small, inexpensive, fast computers. Such innovations offered the potential of almost complete replacement of paper-based Technical Information through the use of light, easily stored, highly capable electronically processible media, which at the same time were capable of more effective interactive display to the end user.

Research, Development, Test, and Evaluation efforts of the three Services during this past decade have conclusively demonstrated, both through field tests and through in-house analyses and experimentation, the feasibility and intrinsic value of providing integrated Technical Information in paperless form in such a way that it can be displayed to end users by means of an interactive Electronic Display System.

For example, the Navy Technical Information Presentation System (NTIPS) Program at David Taylor Research Center, the Navy's Lead Laboratory for TI automation, demonstrated under operational conditions the improvements achievable in maintenance-technician performance [Refs (1) and (2)] through the use of electronically displayed TI. Similar results have been achieved by the Air Force under its Computer-based Maintenance Aiding Information System (CMAS) and its Integrated Maintenance Information System (IMIS) programs [Refs (3) and (4)]. The Army has automated Training Information under its Electronic Information Delivery System (EIDS), and has assessed the capability of using field portable maintenance aids under the Militarized Electronic Information Delivery System (MEIDS) program.

In addition, a number of pilot prototype developments and tests involving land, sea, and air vehicles and their weapon systems are being carried out, by individual System Acquisition Managers of all three Services, in an effort to provide interactive and electronically displayed Technical Information.

Ref (1)   Fuller, Joseph J., Theodore J. Post, and Anne S. Mavor, "Test and Evaluation of the Navy Technical Information Presentation System (NTIPS), F-14A Field Test Results," DTRC-88/036 (Sep 1988).

Ref (2)   Fuller, Joseph J., Raymond L. LeBeau, Anne S. Mavor, Theodore J. Post, and Charles S. Sawyer, "Test and Evaluation of The Navy Technical Information Presentation System (NTIPS), AN/SPA-25D Test Results," DTRC-88/035 (Sep 1988).

Ref (3)   Thomas, D.L. and J.D. Clay, "Computer-Based Maintenance Aids for Technicians: Project Final Report," Air Force Human Resources Laboratory, AFHRL-TR-87-44 (Aug 1988).

Ref (4)   Link, W.R., J.C. Von Holle, and D. Mason, "Integrated Maintenance Information System (IMIS): A Maintenance Information Delivery Concept," Air Force Human Resources Laboratory, AFHRL-TP-87-27 (Nov 1987).

1.2 DOD AND TRI-SERVICE PROGRAMS ESTABLISHED IN RESPONSE TO TECHNICAL INFORMATION AUTOMATION POLICY

To coördinate and standardize the increased use of computer-aided logistic support throughout the three Services, the Department of Defense established the Computer-aided Acquisition and Logistics Support (CALS) program [see Ref (5)], which also has had a wide effect in stimulating progress toward the goal of TI automation, and particularly toward standardization of such efforts.

The Department of Defense established [Ref (5)], and later reiterated [Ref (6)], a policy requiring that access to and the delivery of system-related logistic-support information be automated.

For example, Ref (6) provided the following directions:

a. For systems now in full-scale development or production, program managers were required to review specific opportunities for cost savings or quality improvements that could result from changing delivery or access using the Computer-aided Acquisition and Logistics Support standards.

b. For systems entering development after September 1988, acquisition plans, solicitations, and related documents

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Ref (5)   DEPSECDEF MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS, of 24 Sep 1985. Subj: Computer Aided Logistic Support.

Ref (6)   DEPSECDEF MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS AND DIRECTOR, DEFENSE LOGISTICS AGENCY, of 5 Aug 1988. Subj: Computer-Aided Acquisition and Logistic Support.

required specific schedule and cost proposals for:
(1) integration of Contractor Technical Information systems and processes;
(2) authorized Government access to Contractor data bases; and
(3) delivery of Technical Information in digital form.

c. DOD components were to program for automated systems to receive, store, distribute, and use digital weapon-system Technical Information, including achieving the earliest possible date for digital input to DOD engineering data repositories.

More recently, the Joint Uniform Service Technical Information System (JUSTIS) concept has been announced, a planned effort which will combine, to as great a degree as possible, Tri-Service procedures and equipment for acquisition and control of system-support Technical Information.

1.3 THE INTERACTIVE ELECTRONIC TECHNICAL MANUAL CONCEPT

The culmination of this effort throughout the 1980s in response to the DOD policy statements cited has been the development of the Interactive Electronic Technical Manual (IETM) Concept. The IETM Concept involves full application of existing technological capabilities to the problems of providing Technical Information which is both more effective for the end user and more efficient in terms of acquisition, control, and update.

The IETM Concept involves a system approach, which includes basically all of the following components:

a. A standardized, automated, revisable source Data Base.

b. Use of a computer-controlled authoring system.

c. The generation of digital Technical Information (containing text and graphics), either directly by an Author, or automatically by computer. This Technical Information is recorded on an electronically processible medium (optical or magnetic), rather than on paper.

d. Technical Information (consisting of task-related increments) which is optimally arranged and formatted for interactive screen presentation.

e. Presentation (display to the end user) by means of a computer-controlled Electronic Display System (EDS) possessing an extensive user-interaction capability. The EDS is capable of displaying the IETM, performing related logistic-support functions, and interfacing with other Service logistic-support Information Systems.

An IETM permits a user to locate required information more easily, and to present it faster, more comprehensibly, more specifically matched to the configuration, and in a form that requires much less storage than paper. Powerful troubleshooting procedures not possible with paper Technical Manuals are possible using the computational capability of the IETM Display Device.

IETMs will be used by maintenance technicians, afloat and ashore; to maintain and operate weapon systems by Intermediate and Depot maintenance activities; and by training personnel.

The IETM Concept has been described in detail in Ref (7).

1.4 PREPARATION OF SPECIFICATIONS AND HANDBOOKS FOR SERVICE-WIDE COORDINATION OF ACQUISITION OF AUTOMATED TECHNICAL INFORMATION

To coordinate this wide-spread effort, the Defense Quality and Standardization Office established in 1989, under the DOD Technical Manual Technology Exchange Subcommittee, chartered by DOD INST 4151.9 [Ref (8)], an Interactive Electronic Technical Manual Working Group, chaired by the Navy, whose primary functions were to:

a. Foster the exchange of ideas and the agreement on a single approach regarding:

(1) the acquisition of IETMs which use computer technology for innovative electronic display; and

(2) presentation of Technical Manual Information among all Department of Defense Agencies.

Ref (7) Rainey, Samuel C., Joseph J. Fuller, and Eric L. Jorgensen, "The Electronic Delivery of Automated Technical Information for Logistics Support of Navy Weapons Systems: Potential, System Description, and Status," DTRC-89/007 (Feb 1989).

Ref (8) DoD Instruction 4151.9 of 3 Jan 1989, "DoD Technical Manual Program Management."

b.   Develop a set of DOD Specifications for:

   (1) The acquisition of IETM data; and

   (2) The Electronic Display Systems needed for the
       presentation of IETMs for the maintenance of DOD
       weapons, systems, and equipment.

   The Working Group was also charged with the responsibility
of providing a recommendation to the DOD CALS Policy Office
concerning inclusion of IETM interchange Specifications into
the set of CALS standards; e.g., in connection with
MIL-STD-1840.

   The Tri-Service Working Group consists of representatives
of (a) the David Taylor Research Center (DTRC) of the Navy,
(b) the Air Force Logistics Command (AFLC-MMDE), and (c) the
US Army Communications-Electronics Command (AMCPM-TMDE).

   With DTRC and the Air Force Human Resources Laboratory (as
an advisor to AFLC) contributing the primary effort, a series
of five Specifications (see Section 2.3) and Handbooks for IETM
acquisition has been drafted. This series consists of:

   ■ A Specification governing the nature of the Revisable
     IETM Data Base;

   ■ A Specification providing general Content, Style, Format,
     and User-Interaction requirements for all IETMs;

   ■ A Handbook describing for a System Acquisition Manager
     the best approach to writing acquisition Specifications

for individual View Packages (to be used for IETM procurement);

- A Handbook presenting requirements for the Electronic Display System;

- A Specification presenting requirements for an IETM Quality Assurance Program.

These documents have been widely circulated for comment within both the DOD and Industry.

These drafts were also developed to accomplish as near-term objectives the provision of a suite of IETM prototype acquisition documents for use by major DOD programs in establishing initial IETM capabilities. These programs include the Navy's A-12 Attack Aircraft Program, the Advanced Tactical Fighter Program of the Air Force, and the M-1 Main Battle Tank Program of the Army.

1.5 PURPOSE OF PRESENT REPORT

The purpose of the present Report is to present and to describe in detail one of these draft documents, specifically: MIL-HDBK-EDS (Navy). *Military Specification. Electronic Display System (EDS) for Interactive Electronic Technical Manuals (IETMs).* 1 June 1990.

A series of four other Reports has been prepared, each Report describing one member of the set of five acquisition documents prepared by this Working Group [Ref (9) through Ref (12)].

Section 2 of this Report provides an overall description of this suite of Acquisition Specifications and Handbooks. Section 3 summarizes the Approach and Requirements of one of the five documents; in this case, MIL-HDBK-EDS (Navy). The draft version of MIL-HDBK-EDS (Navy) is included in this Report as Appendix A.

Ref (9)   Rainey, Samuel C., Eric L. Jorgensen, and Joseph J. Fuller, "Proposed Draft Military Specification for Revisable Data Base for Support of Interactive Electronic Technical Manuals (IETMs)," DTRC Report 90/027 (Jul 1990).

Ref (10)   Rainey, Samuel C., Eric L. Jorgensen, and Joseph J. Fuller, "Proposed Draft Military Specification for Quality Assurance (QA) Program Requirements for Interactive Electronic Technical Manuals (IETMs)," DTRC Report 90/024 (Jul 1990).

Ref (11)   Rainey, Samuel C., Eric L. Jorgensen, and Joseph J. Fuller, "Proposed Draft Military Handbook for Preparation of View Packages in Support of Interactive Electronic Technical Manuals," DTRC Report 90/026 (Jul 1990).

Ref (12)   Jorgensen, Eric L., Samuel C. Rainey, and Joseph J. Fuller, "Proposed Draft Military Specification for General Content, Style, Format, and User-Interaction Requirements for Interactive Electronic Technical Manuals (IETMs)," DTRC Report 90/028 (Jul 1990).

2.0 ACQUISITION DOCUMENTATION FOR INTERACTIVE ELECTRONIC TECHNICAL MANUALS AND ASSOCIATED TECHNICAL INFORMATION

2.1 DEFINITIONS

2.1.1 The Interactive Electronic Technical Manual (IETM).

As defined by the Working Group, an *IETM* is a Technical Manual, prepared (authored) by a Contractor and delivered to the Government, or prepared by a Government Activity, in digital form on a suitable medium, by means of an automated authoring system; designed for electronic-screen display to an end user; and possessing the following three characteristics:

a. The format and style of the presented information are optimized for screen presentation to assure maximum comprehension; that is, the presentation format is "frame-oriented", not "page-oriented".

b. The elements of Technical Information constituting the TM are so interrelated that a user's access to the information he requires is facilitated to the greatest extent possible, and is achievable by a variety of paths.

c. The computer-controlled TM-Display Device can function interactively (as a result of user requests and information input) in providing procedural guidance, navigational directions, and supplemental information; and also in providing assistance in carrying out logistic-support functions supplemental to maintenance.

This terminology is consistent with the standard DOD definition of *Technical Manual*. Ref (8), states:

> Technical Manuals are publications that contain instructions for the installation, operation, maintenance, training, and support of weapon systems, weapon-system components, and support equipment. TM information may be presented in any form or characteristic, including but not limited to hard printed copy, audio and visual displays, magnetic tape, discs, and other electronic devices. They normally include operational and maintenance instructions, parts lists or parts breakdowns, and related technical information or procedures exclusive of administrative procedures. Technical Orders (TOs) that meet the criteria of this definition may also be classified as TMs.

2.1.2 The View Package.

IETM information, as provided to the end user for viewing on an Electronic Display Device, will be constructed in individual task-oriented increments called View Packages.

A *View Package (VP)* is a fully organized and formatted item of computer-processible Technical Information derived from an IETM Data Base and capable of interactive electronic display to an end user by means of an Electronic Display System (EDS). In function and design, a View Package is completely equivalent to an individual Interactive Electronic Technical Manual. A View Package may be constructed:

a. entirely by an Author using an automated authoring system;

b. completely automatically using a series of automated processes (software) which perform the data-selection, structuring, and formatting processes; or

c. by a combination of the above two approaches.

A View Package is designed to support a specific function in the operation or logistics-support of a weapon system or other military equipment.

2.1.3 Nature and Purpose of the Revisable IETM Data Base

As noted above, a View Package is created entirely from data contained in a *Revisable IETM Data Base* (IETMDB), which is a complete collection of Data Elements relating to a weapon system or other equipment acquired by the Government and constructed in a standardized procedure in order to provide the following capabilities:

a. Government Activities or DOD Contractors concerned with logistic support for the weapon system involved can access the Data Base directly to obtain needed logistic-support information for specific purposes.

b. The IETMDB can serve as the basis for construction and update of the entire suite of electronically displayed interactive weapon-system Technical Manuals through the use of automated authoring systems.

c. The IETMDB can serve as the basis for fully automated construction, by either a Contractor or a

Government Activity, of View Packages, which are increments of interactive electronically presented logistic-support Technical Information.

d. Required portions of the IETMDB can be interchanged by means of standardized procedures throughout the DOD and its supporting Contractors on a real-time basis when needed.

2.1.4 The Electronic Display System (EDS)

The EDS is a computer-based Technical Information system designed to accept, process and integrate Technical Information for prime-equipment logistics support, and display that information to users. The EDS is also intended to support inquiries by users (in addition to Operations and Maintenance users) who have such responsibilities as supply, training, field-data collection, readiness measurement, operations scheduling, maintenance planning, maintenance quality control, and hardware configuration control. The software supporting the EDS will also be required to support additional (as yet unspecified) functions in the future, which will emerge as technologies and standards evolve. Specifically, the EDS is intended for use:

a. In maintenance Work Centers and shops to support Troubleshooting and Planned and Corrective Maintenance;

b. In portable form at remotely located maintenance sites;

c. Embedded in a weapon-system control panel as support both for System operation and System maintenance;

d. In presenting operating and maintenance information during personnel training courses;

e. In a variety of centers and offices in support of System-related, logistics-supported functions which require Technical Information.

The Electronic Display System will consist of one or more computer-controlled Devices which display the required Technical Information by means of a screen (such as a cathode-ray-tube or a plasma display) either in a pre-ordered sequence or in random-access increments, as called for by the user; e.g., a maintenance technician. To accomplish this display, the IETM, consisting of the Technical Information recorded on a suitable medium (e.g., on an optical disc), is designed to be loaded into the EDS, "read" by this Device, and displayed in a sequence as directed by the user.

The IETMs to be used by this Display System must accordingly be so constructed as to assure full compatibility with the operating software of the Display Device, and must be tested by the preparing Contractor on such a Display Device prior to delivery.

2.1.5 Summary

As noted, all IETMs:

a. Will be constructed through the use of an automated authoring system, and will consist of task-related increments referred to as View Packages;

b. Will be based on an automated system Data Base, the IETMDB, prepared by the System Prime Contractor for delivery as such to the Government, retention for his own use, or both;

c. Will consist of a digital data stream recorded on an optical or magnetic medium, but not paper, electronically displayed by the Electronic Display System in terms of text and graphics;

d. Will be optimally formatted and styled for screen presentation (i.e., "frame oriented" rather than "paper oriented").

e. Will be constructed for electronic display on a highly interactive Electronic Display System, which will support related logistic-support functions and which may be networked for interface with other Service Information Management Systems.

2.2 IETM PROCUREMENT OPTIONS

Logistic-support procedures for weapon systems and related equipment differ to some extent among the Services. A certain amount of necessary variation in the acquisition procedures involving the VPs, the IETMDB, and the EDS has been provided in the system of Specifications and Acquisition Handbooks developed by the IETM Working Group.

Thus, these Specifications and Handbooks detail several optional approaches in the acquisition of IETMs. These are as follows:

a.   Using appropriate IETM Specifications, the Service may buy whatever directly-authored Interactive Electronic Technical Manuals are required. Although the Author (equipment Prime Contractor) will need to establish an automated equipment or weapon-system (source) Data Base, this Data Base will not be acquired by the Government, but will be maintained and used by the Contractor, both for the preparation of IETMs and for other purposes.

   (1) As an option, the Government might contract for on-line access to technical portions of this Contractor-owned Data Base. In such a case, both content and accessibility aspects of the IETM Data Base would have to be constructed to standard requirements.

b.   Acquisition by the Government of directly authored IETMs (fully prepared and validated by the Contractor) as well as the IETM Data Base upon which they are based. Government acquisition of the IETM Data Base may involve either of the following options:

   (1) Delivery to the Government in standardized form and subsequent maintenance by the Government (with or without update information supplied on a continuing basis by the Contractor);

   (2) Title acquired to the IETM Data Base by the Government, but with the Data Base retained and

maintained in the Contractor's plant. The Government to be provided with on-line access to the Data Base.

c. Based on acquisition of the IETM Data Base, using either option b.(1) or b.(2), preparation of View Packages using either a fully automated process or one which is essentially fully automated. View Packages could be prepared either:

(1) By the Contractor [based on Data-Base acquisition option b.(1)], and delivered as such to the Government, or

(2) By the Government [based on Data-Base acquisition option b.(2)].

2.3 SUMMARY AND PURPOSE OF THE DRAFT ACQUISITION SPECIFICATIONS AND HANDBOOKS PREPARED BY THE TRI-SERVICE IETM WORKING GROUP

As noted, five draft Specifications and Handbooks have been prepared, and circulated widely for DOD and Industry comment, to provide System Acquisition Managers with the necessary contractual documentation for acquisition of Interactive Electronic Technical Manuals, the associated Source Data Base, and the necessary Electronic Display Systems. These statements of requirements are preliminary and will certainly be modiⅼied as experience is gained with the acquisition, management, and use of this type of Technical Information, as the technology advances, and as the Department of Defense

improves its in-house logistic-support infrastructure for support of IETMs.

The five draft Specifications and Handbooks prepared by the Inter-Service IETM Working Group (of which Appendix A of this Report is one), together with individual statements of the purpose of each document, are as follows:

2.3.1 The Revisable IETM Data Base Specification

2.3.1.1 Title

Draft MIL-D-IETMDB. *Revisable Data Base for Support of Interactive Electronic Technical Manuals (IETMs).* 1 June 1990.

2.3.1.2 Purpose

This Specification contains the requirements for a Revisable Interactive Electronic Technical Manual Data Base (IETMDB) to be constructed by a weapon-system Contractor. This non-redundant and neutrally formatted Data Base is intended to be the single source of data for all Technical Manuals to be used in support of a given weapon system, or other equipment being acquired by the Government. This Specification may be used in two primary modes:

a. as a set of standard requirements to which the Contractor must adhere in the development and

maintenance of his internal Data Base for subsequent conversion to Government-deliverable form;   and

b.   as a set of requirements for a Data Base that is physically delivered to the Government, or is maintained by the Contractor on behalf of the Government.

2.3.2   The IETM General Content, Style, Format, and User-Interaction Requirements Specification

2.3.2.1   Title

Draft MIL-M-GCSFUI.   *Manuals, Interactive Electronic Technical: General Content, Style, Format, and User-Interaction Requirements for.*   1 June 1990.

2.3.2.2   Purpose

This Specification contains common requirements for the Content, Style, Format, and User-Interaction features required for Interactive Electronic Technical Manuals and the operating software of the devices upon which they are viewed.   These IETMs are to be delivered to the Government in digital form and must be designed for interactive display to the maintenance-technician end-user by means of a computer-controlled Electronic Display System.   The range of IETMs for which general requirements are described in this Specification will cover the maintenance, diagnostic, training, system-operation, parts-information, and installation functions which are required to achieve and maintain full operational capability of a specific weapon system or other military equipment.

2.3.3 The IETM View Package Handbook

2.3.3.1 Title

Draft MIL-HDBK-IETMVP. *Guidelines for Developing Specifications for Interactive Electronic Technical Manual (IETM) View Packages.* 1 June 1990.

2.3.3.2 Purpose

The purpose of this Handbook is to provide guidance for the preparation of individual View-Package Specifications, so that System Acquisition Managers may define View Package Requirements quickly and effectively for the numerous different specialized increments of Technical Information which will be required. A Handbook of this type has been referred to as a meta-specification: a Specification describing how to write a View Package Specification which is the end-item Specification for procurement of an actual IETM.

2.3.4 The IETM QA Program Requirements Specification

2.3.4.1 Title

Draft MIL-M-IETMQA. *Quality Assurance (QA) Program Requirements for Interactive Electronic Technical Manuals (IETMs) and Associated Technical Information.* 1 June 1990.

2.3.4.2 <u>Purpose</u>

This Specification prescribes the requirements for a Contractor's QA program for Interactive Electronic Technical Manuals (IETMs) and, where procured, the associated IETM Data Bases and supporting View Packages. The requirements herein cover the QA process and present the plan for implementing it, from planning through final submission of the delivered product for acceptance; they apply as well to changes and revisions thereto.

2.3.5 <u>The Electronic Display System Handbook</u>

2.3.5.1 <u>Title</u>

Draft MIL-HDBK-EDS (Navy). *Electronic Display System (EDS) for Interactive Electronic Technical Manuals (IETMs).* 1 June 1990.

2.3.5.2 <u>Purpose</u>

This Handbook describes the basic functional requirements for an Electronic Display System (EDS) designed to display Interactive Electronic Technical Manuals (IETMs). It establishes the minimum system requirements to be used in a detailed Specification for competitive procurement, either for portions of the full requirements or tailored to suit the application, user environment, device compatibility, and interfaces to existing computer systems.

The requirements described in this Handbook are of three types:

   a. Those which describe the Electronic Display System hardware;

   b. Those which describe the EDS software of the display System for system operation, IETM applications, and utility functions.

   c. Those which specify the minimum performance of the several individual Display Devices which constitute the EDS.

To achieve full compatibility of the EDS with the IETMs and View Packages, the Display System Software (as well as the View Package) must also be constructed in compliance with MIL-M-GCSFUI.

Each of the three Services has its own strategies for developing Specifications and Standards for an Electronic Display System. This Handbook presents the existing Navy concepts, and is accordingly identified as a Navy-only document. Proposed concepts of the other Services which do not differ extensively from requirements described in this Handbook will be included in succeeding versions of the Handbook.

2.4 RELATIONSHIP OF MIL-HDBK-EDS (NAVY) TO OVERALL SET OF IETM-ACQUISITION SPECIFICATIONS AND HANDBOOKS

An increment of IETM Technical Information, referred to as a View Package, must be displayed on an Electronic Display System (EDS) which has been specially designed to accept the

24

data stream of the View Package, to interpret the VP software in terms of display commands, to provide the user-interaction capability built into the View Package, and to host the software required for the performance of collateral functions required to support the logistic-support function for which the VP has been designed (e.g., parts ordering or maintenance-action reporting). Thus, to achieve any degree of uniformity among the three Services, the EDS design (both hardware and software) must embody numerous standardized characteristics of the IETM concept.

At the same time, the wide variation of types of military systems to which the VPs will apply, the variation in maintenance and other logistic-support processes of the three Services, and the wide range of operational environments in which such Display Systems will be used have made it infeasible to prepare an Acquisition Specification containing a single set of EDS hardware and software requirements at this time.

Accordingly, a Handbook has been generated for Industry and Service review which provides a statement of as many requirements as presently possible to serve as the basis for as much inter-Service standardization as can be achieved.

Requirements, both hardware and software, have been presented largely in functional terms. Where specific requirements have been included (e.g., maximum weight and volume figures for a portable Electronic Display Device), such values are included to illustrate the functional requirements proposed (i.e., in this case, of portability).

The EDS design is influenced strongly by the Style, Format, and User-Interaction Requirements of all View Packages [detailed in Ref (12)], by the design of the View Packages themselves [Ref (11)], and by the performance of an adequate QA process [Ref (10)], since any Display Device used in QA must be identical to that which will be provided to the end user.

3.0 SUMMARY OF MIL-HDBK-EDS (NAVY)
ELECTRONIC DISPLAY SYSTEM (EDS) FOR
INTERACTIVE ELECTRONIC TECHNICAL MANUALS (IETMs)

3.1 EDS FUNCTIONAL OVERVIEW

The functions which must be fulfilled by the several components of an Electronic Display System functioning as a critical part of the IETM approach have been summarized in Section 2.1.4.

More particularly, the EDS must:

a. Display IETM View Packages in a fully interactive and comprehensible manner to a using technician. Such View Packages will vary widely in design and purpose. They must provide guidance for maintenance and other direct forms of system logistic support, for system operations, and for training; and they must be capable of being viewed in a wide variety of environments.

b. Permit the performance of a number of functions related to the direct performance of the tasks or other functions presented by the View Package itself; these functions are referred to by MIL-HDBK-EDS as Special Utilities (see Section 3.4.3 of the Handbook). They include:

    (1) Incorporation of Rapid Action Changes into the View Package;

(2) Technical Information error and deficiency reporting;

(3) Provision of a supply-system interface (e.g., for ordering a part);

(4) Provision for Maintenance Action reporting;

(5) Provision of a maintenance audit trail;

(6) Support of Work-Center Maintenance Management (scheduling, assignment, status of equipment under a given Work Center).

c. Function as a communication node in a Local Area Network, permitting the transfer of information from one EDS terminal to another, and providing an entry port to relevant Information Management Systems used by the Service for logistic support of its weapon systems and other military equipment.

3.2 ELECTRONIC DISPLAY SYSTEM ARCHITECTURE

The basic system architecture of the EDS is that of a highly integrated networked capability which, nevertheless, allows autonomous operation of each individual Electronic Display Device (EDD). The system configuration includes a network server, a number of individual Display Devices of several types, a standard data-communications network, and supplementary printers. This configuration permits integrated operation of the system and autonomous operation of each individual Delivery Device.

The EDS architecture is also designed so that functional modules may be added or deleted to customize the application needs without altering the basic design.

3.3 EDS COMPONENTS AND FUNCTIONS

The Electronic Display System consists of four types of components, although not all of these components will necessarily be acquired for any given equipment procurement.

3.3.1 The Work Center Device

The Work Center Device is a bench-mounted Display Device operating from facility power mains, with software capabilities, memory, and buss connections to permit it to carry out the following four types of functions:

a. Library/Storage function; i.e., automated access to, and storage of, a wide variety of Technical Manual information to which a technician can obtain immediate access. If the volume of IETM information involved requires it, the Work Center Device can be provided with multi-medium peripheral storage capability (e.g., hard-disk, CD/ROM, or WORM) on which it can draw as required.

b. Display of Interactive Electronic Technical Manuals or View Packages (text and graphics) to a using technician as required.

c. Communication with other information systems of the ship or station, with a printer, with a Portable Electronic Display Device, and with other Work Center Electronic Display Devices constituting the nodes of a Local Area Network.

d. Support for the performance of the Utility functions described in Section 3.1.1.b.

One Work Center device which constitutes a node of the Facility Local Area Network will function as the "Network Server"; that is, it will perform the following functions:

a. Provide for multi-user/multi-tasking capability;

b. Be the central repository for the IETM database; and

c. Provide for central control and management of EDS operations, applications, and interfaces to external computer systems.

3.3.2 The Portable Display Device

This component of the EDS is intended to be carried by a technician to a location remote from a maintenance center, to support performance of some fairly limited task, and to display only that Technical Information (downloaded from a Work Center Device) required for this purpose. It will operate either from facility power mains or from battery power. Size and weight will be small enough to assure its convenient portability in the kinds of (often inconvenient) maintenance environments involved. Memory will be limited but adequate to handle

screen-displayed TI equivalent to several hundred pages of conventional Technical Manuals. The downloaded information is to be discarded (i.e., erased) once used.

3.3.3 The Rack-Mounted Device

The Rack-Mounted Display Device is functionally equivalent to a Work Center Display Device, but permanently located (rack-mounted) as a part of one of the (relatively few) shipboard, field, or air-station systems where maintenance is always carried out in some specific compartment or location (e.g., a ship-performance monitoring system). Such a Device will maintain TI sufficient for all locally performed logistic-support functions downloaded from a Work Center Device, on some non-volatile memory medium, on a continuing basis.

3.3.4 Supplementary Printers

Although the IETM concept will reduce to a minimum dependence on hard-copy Technical Information, provision has been made in the IETM system design for supplementary printers (to print selected View Package information) which may be needed under unusual circumstances.

Two types of printers are included:

a. A supplementary graphics printer for drawings up to B-size (11" x 17"), which could be used by a technician to reproduce on paper a large logic-flow diagram, wiring diagrams, or other schematic.

b. An optionally provided 8½" x 11" printer as supplementary equipment for one or more Work Center Devices of a LAN, for miscellaneous use in conjunction with the Work Center mission.

3.4 TYPES OF REQUIREMENTS PRESENTED BY MIL-HDBK-EDS

MIL-HDBK-EDS summarizes EDS requirements of the following types:

a. Minimum performance requirements which will be necessary for the system and its components to carry out the functions which have been summarized in Section 3.1.1 and which are related to the individual system components in Section 3.2.1 of this Report.

b. Hardware requirements determined by the functional requirements of the system and its components.

c. Software requirements determined by the functional requirements of the system and its components.

d. User-interaction requirements and requirements for interfaces with other systems and functions of the Service logistic-support process.

e. Environmental requirements; i.e., requirements which components of the EDS must meet to be able to perform in the wide variety of work locations where they will be needed.

3.4.1 Hardware Considerations

MIL-HDBK-EDS presents proposed hardware requirements for the Electronic Display System as a whole and for each of the system components (described under Section 3.3 above). Particular emphasis is paid to the construction and capabilities of:

a. The Display screens for the three Display Device configurations. Screen factors specified include screen type, size, resolution, pixel-aspect ratio, viewing angle, color (optional), and gray-scale requirements.

b. Those hardware features (User-Interaction hardware and I/O mechanisms) of the Display System involved, in assuring full User-Interaction capability for the system. For example, see Section 3.3.1.1 and Section 3.3.2. Such features include requirements for an alphanumeric keyboard; special-function keypad; mouse, trackball, or joy-stick; touch-screen; cursor; and the like.

3.4.2 Software Requirements

MIL-HDBK-EDS presents (Section 3.4) functional requirements for a number of aspects of software, that must be a part of the EDS design, which must complement completely the software that is a part of the individual View Package design. These include:

a. Software for external interfaces;

b. EDS File Management;

c. Network Management;

d. Graphics Display Management;

e. Data Security;

f. Special I/O Provisions (e.g., voice registration for audio capability);

g. VP-Configuration Management.

h. Built-In System Test Software.

3.4.3 Environmental Requirements

The Handbook summarizes characteristics of the wide range of environments in which the various components of the EDS must perform. These environmental requirements include use on ship while underway, use in open-air flightline repair, and equipment maintenance on the battlefield under inclement weather conditions.

At the opposite extreme, EDS components (possibly acquired under less stringent Specifications) will be extensively used in environmentally controlled repair shops and Work Centers for O-level, I-level, and D-level activities. The anticipated range of environmental requirements is provided for each of the four types of EDS components proposed. Repairability and maintainability requirements under such operating conditions are also presented.

3.4.4 User-Interaction Requirements

In addition to the User-Interaction capabilities of the EDS, which must be designed into the system hardware (Section 3.4.1, above), general human-engineering and usability requirements are also detailed by the Handbook. These include:

a. Design for simplicity of use and reliability;

b. Design for user-friendliness;

c. Training requirements for EDS use;

d. Health and Safety factors;

e. Provision of How-to-Use-the-EDS and other Help information ;

f. Protection against loss of information as a result of system or power failure.

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APPENDIX A

Copy of Draft Military Handbook:
MIL-HDBK-EDS (Navy). *Electronic Display System (EDS) for Interactive Electronic Technical Manuals (IETMs).*
1 June 1990

Prior to the publication of this report the document included as Appendix A has been officially submitted to the DOD Defense Quality Standardization Office and the DOD CALS Policy Office by the Office of the Chief of Naval Operations, Code 403 - Logistics Policy (OPNAV LTR 4160 Ser 403T/OU593187 dtd 4 Jun 1990). It has also been submitted to the Pageless Technical Manual Working Group of the Aerospace Industry Association for Review and Comment. This document was distributed as a review draft and is largely a DTRC product with assistance from the Air Force as noted. This Appendix is in the exact form that was submitted to these organizations.

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NOTE: This review draft has been prepared by DTRC for purposes of technical review and comment by Industry and DOD organizations. It has not been approved and is subject to modification. DO NOT USE FOR ACQUISITION PURPOSES.

****REVIEW DRAFT****

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: David Taylor Research Center, Code 182.3, Bethesda, Maryland 20084-5000.

MILITARY HANDBOOK (NAVY)

ELECTRONIC DISPLAY SYSTEMS FOR

INTERACTIVE ELECTRONIC TECHNICAL MANUALS (IETMs)

Table of Contents

ELECTRONIC DISPLAY SYSTEMS FOR

INTERACTIVE ELECTRONIC TECHNICAL MANUALS (IETMs)

1. SCOPE

This handbook describes the basic functional requirements for an Electronic Display System (EDS) designed to display Interactive Electronic Technical Manuals (IETMs). It establishes the minimum system requirements to be used in a detailed specification for competitive procurement. Such procurement may be for portions of the full requirements described herein, or tailored to suit the application, user environment, device compatibility, and interfaces to existing computer systems.

The requirements described in this Handbook are of three types:

a. Those which describe the Electronic Display System hardware;

b. Those which describe the EDS software of the Display System for system operation, IETM applications, and utility functions;

c. Those which specify the minimum performance requirements of the several individual Display Devices which constitute the EDS.

1.1 Interactive Electronic Display of Technical Information

Interactive Electronic Display of Technical Information consists of presenting interactively to an end user, by means of a computer display, specially formatted and integrated text/graphics information which will guide his actions in performing system-maintenance, operational, or other logistics-support functions.

The Interactive Electronic Technical Manual is constructed in such a way that the end user may ask questions of the system, input test data, request the display of Help information, and view several types of related data simultaneously. Similarly, the Display System can prompt the user in his procedures, offer advice, display warnings, and point out errors or omissions in his efforts. The end user may also use the Electronic Display System interactively to accomplish such functions as Work-Center maintenance management, maintenance action reporting, or parts ordering.

1.2   The Electronic Display System (EDS)

The EDS is a computer-based Technical Information system designed to accept, process and integrate Technical Information for prime-equipment logistics support, and display that information to users. The EDS is also intended to support inquiries by users (in addition to Field or Fleet maintenance technicians and weapon-system operators) who have such responsibilities as supply support, training, field-data collection, maintenance planning, maintenance quality control, and hardware/Technical-Information configuration control. The software supporting the EDS must be developed to support additional (as yet unspecified) functions in the future, which will emerge as technologies and standards evolve. The Electronic Display System defined by this Specification is intended for use:

a. In maintenance Work Centers and shops to support Troubleshooting and Planned and Corrective Maintenance;

b. In portable form at a remotely located maintenance site;

c. Embedded in the weapon-system equipment racks as dedicated support both for System operation and System maintenance;

d. In presenting operating and maintenance information during personnel training courses;

e. In a variety of centers and offices in support of System-related, logistics-supported functions which require Technical Information.

1.3   Interface between the Electronic Display System and the Interactive Electronic Technical Manual

The Electronic Display System will consist of a computer-controlled Device which displays the required Technical Information by means of a screen (such as a cathode-ray-tube or a plasma display) either in a pre-ordered sequence or in random-access increments, as called for by the user; e.g., a maintenance technician. To accomplish this display, the IETM, consisting of the computer-readable Technical Information recorded on a suitable medium (e.g., on an optical disc), is designed to be loaded into the EDS, "read" by this Device, and displayed in a sequence as directed by the user. Thus, one EDS interface is with the medium which contains the IETM and which is designed to be loaded onto and "read by" the EDS.

The IETMs to be used by this Display System will accordingly be so constructed as to assure full compatibility with the operating software of the Display Device, and will be tested by the preparing Contractor on such a Display Device (i.e., on the Government-

specified Device which will be used by logistics-support technicians) prior to acceptance by the Government in accordance to the provisions of MIL-Q-IETMQA: *Quality Assurance (QA) Program Requirements for Interactive Electronic Technical Manuals (IETMs) and Associated Technical Information..*

To assure commonality and uniformity of IETM presentations across any Military Service, the operational software designed for the EDS and the IETMs which are procured for the device must conform to certain standards which are specified in MIL-M-GCSFUI: *Manuals, Interactive Electronic Technical, General Content, Style, Format and User-Interaction Requirements for.* Most of the requirements cited in that Specification (to which the IETM author must also conform) have a counterpart in this Electronic Display System Specification (which requires a capability the System designer must provide so that the corresponding TM capability can be realized in displaying Technical Information to the user).

2. APPLICABLE DOCUMENTS

The following documents are recommended for inclusion in section 2 of an EDS procurement specification. The section should include the following phrase at the beginning of Section 2:

"Unless otherwise specified, the following specifications and standards form a part of this specification to the extent specified herein. Specification and standard issues shall be those listed in that issue of the Department of Defense Index of Specifications (DoDISS) specified in the applicable contract."

2.1 Government Documents

2.1.1 Specifications and Standards

2.1.1.1 Specifications

MIL-M-GCSFUI	*Manuals, Interactive Electronic Technical, General Content, Style, Format, and User-Interaction Requirements for.*
MIL-P-9024	*Packaging, Materials Handling, and Transportability, System and System Segments, General Specifications for*
MIL-Q-9858	*Quality Program Requirements.*
MIL-Q-IETMQA	*Quality Assurance (QA) Program Requirements for Interactive Electronic Technical Manuals (IETMs) and Associated Technical Information.*

MIL-E-16400   Electronic, Interior Communication, and
Navigation Equipment, Naval Ship and Shore,
General Specifications for.

MIL-E-5400   Electronic Equipment, Aerospace General
Specification for.

MIL-HDBK-217   Reliability Predictions of Electronic
Equipment.

2.1.1.2 Standards

MIL-STD-109   *Quality Assurance Terms and Definitions.*

MIL-STD-454   *Standard General Requirements for Electronic
Equipment*

MIL-STD-810   *Environmental Test Materials and Engineering
Guidelines*

MIL-STD-1472   *Human Engineering Design Criteria for
Military Systems, Equipment, and Facilities.*

DOD-STD-2167   *Defense System Software Development*

DOD-STD-2168   *Defense System Software Quality Program*

2.1.2 Other Government Documents

MIL-HBOOK-IETMVP   *Preparation of View Packages in Support of
Interactive Electronic Technical Manuals*

2.2 Other Documents

FIPS 151   POSIX Standard

FIPS 146   GOSIP Standard

2.3 Order of Precedence

The following sentence should be included in section 2.3 as follows:

"In the event of a conflict between the text of this Specification and the references cited herein, the text of this Specification shall take preference."

3. REQUIREMENTS

3.1 General Requirements

3.1.1 General User-Support Functions

The functions of the Electronic Display System are as follows:

3.1.1.1 System Maintenance and Operation

The EDS shall present comprehensible high-quality Technical Information to technicians engaged in Planned Maintenance, Troubleshooting, and Corrective Maintenance of Military systems, and to technicians involved in System operation. This presentation must be primarily in a visual form designed specifically for the operational environment involved.

3.1.1.2 Training

The EDS shall present suitable training information, in schools or on-station (e.g., on-board ships) for instructor-controlled or self-paced training to enable technicians to achieve and maintain competence in their system-support functions.

3.1.1.3 Interaction with Other Information Systems

The EDS shall communicate with the shipboard or shore-station logistics-information network to permit consolidation of reports submitted by an individual Work Center (e.g., Maintenance Action Reports, Technical Information Deficiency and Evaluation Reports) and to permit relevant logistics-support communication (e.g., ordering a spare part from an on-station supply center).

3.1.1.4 Other Logistics-Support Functions

The EDS shall permit access by a variety of users who require system-related Technical Information for such functions as planning, readiness evaluations, establishing parts requirements, inventorying, and maintenance-load estimates.

3.1.2 General System Description

3.1.2.1 System Architecture

The basic system architecture of the EDS is that of a highly integrated networked capability but one that allows autonomous operation of the individual Electronic Delivery/Display Devices (EDDs). The system configuration shall consist of a network server, multiple EDDs, a standard data-communications network, and printers. This configuration enables fully integrated operation of the system, autonomous operation of each EDD, and interfaces with maintenance information systems operating outside the EDS. This mix of operation modes is essential for maintaining a high degree of reliability tolerance in the system.

System architectures may be implemented differently for the Portable, Rack-Mounted, and Work-Center configurations. However, the basic philosophy behind each architecture is essentially the same, and provides for maximum flexibility to meet unique requirements for each configuration. The EDS architecture shall be such that functional modules may be added or deleted to customize the application needs without altering the basic design.

Features of this architecture are described below.

3.1.2.1.1 Modularity Scheme

The core of the EDS building block modularity scheme is the processor module that functions as the CPU. To make up the basic EDS configuration, the CPU module is augmented with a communications module that performs input/output and networking functions, a memory module that contains the ROM program memory, a RAM working- or data-memory module, a power supply module, a battery-pack module (Portable Display Device only), an interface module, and a means for loading data from a laser disc/card, or other very-high density storage medium.

3.1.2.1.2 Interface Device

The Interface Device shall include the means for loading data from an external data-storage medium and from the storage Device used on a particular weapon system.

3.1.2.1.3 System Reconfiguration at the Using Activity

Using the modular building block concept, an EDS can be configured at the using Activity for virtually any application, by the addition or deletion of modules. The actual delivered EDS configuration will be defined by the Order or Contract to meet logistics-support needs of the specific prime equipment.

3.1.2.1.4 Communication

The EDS is a distributed network arrangement that includes established nodes, which may be any of three Display-Device configuration types: Work-Center, Rack-Mounted, or Portable. However, the Portable Device is not hard-wired to the network. The Portable Device shall have as one of its modular elements a Communications option that establishes a high-speed data transfer link between the Portable Device and any Work-Center or Rack-Mounted Device.

3.1.2.1.5 Connectivity

The EDS connectivity is a complete environment that enables any Device to communicate with any other Device through networking, direct connection, or storage media.

3.1.2.2 Network Server

One computer terminal of the EDS network shall function as a server to other terminals (nodes) in the System. This network server (hereafter referred to as server) shall:

a. Provide for multi-user/multi-tasking capability;

b. Be the central repository for the IETM database; and

c. Provide for central control and management of EDS operations, applications, and interfaces to external computer systems.

3.1.2.3 The Work-Center Device

A bench-mounted, transportable (but not necessarily Portable) Device, provided with sufficient information-handling capability to access all available IETMs for every system on the ship or station. All of this information need not be on-line, but any required data must be capable of being retrieved immediately by a variety of call methods. The Work-Center Device must be provided with, and capable of communicating through, a suitable data buss to the logistics-communication system of the Organizational level Service activity, other required data-bases, and to a centralized TM-information library (or libraries) for such "O"-level activity if such capabilities are

maintained separately. However, in its function of presenting TI to system-maintenance or system-operation technicians, a Work-Center Device must be capable of entirely autonomous operation. It must be capable of downloading designated TI to a Portable Display Device which will be carried to a separate work site. It must be capable of constituting a node of a Local Area Network which permits intercommunications among the Display Devices (and performs other functions); the LAN must be so constructed that, for example, an IETM contained on a disc in a Display Device in one Work Center can be viewed on a Display Device in another Work Center (another node on the LAN) if needed.

The Work-Center Electronic Display Device is thus required to perform three functions:

a. A Library/Storage function; i.e., automated access and storage of a wide variety of Technical Manual information to which a technician can obtain immediate access. If the IETM volume involved requires it, the Work-Center Device can be provided with peripheral storage capability (e.g., hard-disk, CD/ROM, or WORM, as required), and on which it can draw as required;

b. Display of Interactive Electronic Technical Manuals or View Packages (text and graphics) to a using technician as required;

c. Communication with other information systems of the ship or station, with a printer, with a Portable Electronic Display Device, and with other Work-Center Electronic Display Devices constituting the nodes of a Local Area Network.

3.1.2.4 The Rack-Mounted Device

The Rack-Mounted Display Device is functionally equivalent to a Work-Center Display Device, but permanently located in conjunction with those (relatively few) shipboard, Field, or air-station systems where maintenance is always carried out in some specific compartment or location, where a large number of complex system components are operated (e.g., a ship-performance monitoring system). TI sufficient for all maintenance or operating requirements, downloaded from a Work-Center Device, will be maintained on some non-volatile memory medium (e.g., a floppy disc) on a continuing basis.

3.1.2.5 The Portable Display Device

A Device which presents TI in visual form to a technician who must, for example, repair a system at a site remote from the Work Center. This Portable Device will normally contain digital text-graphics information (including both Troubleshooting and Corrective-Maintenance information) which has been downloaded for the specific

maintenance task at hand from a Work-Center Device. The TI involved must be totally self-sufficient and the Device must be able to handle as much as the equivalent of several hundred pages of a conventional Technical Manual. Once the specific effort is completed, the downloaded TI involved will be disposed of or destroyed.

3.1.2.6 A Supplemental Printer

Although the process of providing digitized Technical Information for electronic display is designed to eliminate reliance on a paper medium, supplementary printers may be provided as a component of the IETM system, as described below.

3.1.2.6.1 "B" Size Printer

The EDS shall be supplemented by a printer capable of producing up to "B" size drawings (11" x 17"). This device will allow printing of technical information that may be required for performance of a specific task, such as a circuit diagram or a large schematic or wiring diagram.

3.1.2.6.2 Work Center Printers

Work-Center devices may be optionally supplemented by a printer capable of printing on standard-sized (8 1/2" x 11") paper. This will support printing of technical information that may be required for performance of a specific task.

3.1.3 Operational Environment

The EDS and its components shall meet the environmental requirements for shipboard and shore-based equipment specified in MIL-E-16400. The system is intended for use:

a. In work centers and at other locations aboard ship;

b. In shops at shore stations (including flight-line use at Naval Air Stations) at the Organizational, Intermediate, and Depot maintenance levels; and

c. For training, either at military schools or on-station (e.g., on-board ship).

The PDD shall function wherever maintenance is performed with the use of technical manuals. The EDDs shall be capable of functioning in wide extremes of ambient light: from brilliant sunshine to a dimly lit interior shipboard compartment.

3.1.3.1 Human Engineering Considerations

The Electronic Display System is to be designed primarily for use by technicians with limited training. System design and contruction shall stress:

a. Simplicity of use;

b. High reliability;

c. Careful attention to good human-engineering policies, as described in MIL-STD-1472; and

d. The assurance of user-friendliness.

Most of these considerations apply also to the software and control aspects of the system, along with the display function (that is, the user command subsystem and user-screen interaction functions).

3.1.3.2 Training Required for Interactive-Display System Use

Technicians who will use this System are expected to be trained in use of the EDS prior to independent performance of logistics-support functions supported by the EDS, but the EDS is to be designed to minimize this training. For example, System design must be such that computer training is not required. Note that a How-to-Use-This-Manual Section is included to supplement the training which has been provided to the technician. All information to be displayed by the System will be covered by this Section.

3.1.3.3 Interdependence between Display-System Design and the IETM

Specification of the Interactive Electronic Technical Manual (or other forms of Technical Information to be displayed on this System) and design of the Display System itself must be closely coordinated. Thus, the Display System itself, as specified by the Government, will be used to Validate all Technical Manuals which are to be displayed with it, as well as for the Verification process. The information displayed on the EDS is the result of both the processing capability of the EDS hardware and software and the organization of the IETM itself. Because of this degree of interrelation, it is important that the display system design and the organization of the IETM be constructed to work together.

3.1.3.4 Interdependence between Display System and IETM

The EDS shall be capable of accepting IETM data digitally inscribed on the medium specified by the Contract or Order. All EDS configurations shall have the capability to load IETM data from a Local Area Network (LAN), a central data-base library, or a logistics communications system. The Portable Display Device shall have the additional capability to upload/download data from the Work-Center or Rack-Mounted Display Devices. As required by the Contract, interface busses or data-cartridge upload/download capabilities may be additionally specified.

3.1.3.5 Local Area Networking

The EDS network hardware and software shall link all nodes of the System to provide fully integrated system operation and control, establishing a LAN for the using Activity. In addition, the network software shall provide a capability for communicating with other local logistics-support information systems.

3.1.3.6 Security

The IETM digital-information coding schemes shall permit safeguarding of the information at its specified level of security classification.

    a. Data Security: The user shall not have the capability to modify any data in the IETM, the View Package, or the IETM Data Base. The software shall be designed to ensure data integrity and data security automatically.

    b. User Security: Through use of personalized passwords, the operating software shall have a capability to control user

access to the IETM and other maintenance information which has been installed on the System.

3.2 Hardware Requirements

3.2.1 Networking

The EDS network hardware (Work-Center Devices functioning as nodes and the busses connecting the nodes) shall link all nodes of the System to provide fully integrated System operation and control, establishing a LAN for the using Activity. In addition, the network shall be constructed as to capability for communicating with other local logistics-support information systems functioning as nodes on the network.

The network shall be Ethernet-compliant. The EDS   shall be designed to become compliant with the Government Open System Interconnection Profile (GOSIP) when that standard has stabilized.

3.2.2 Hardware Categories

Hardware requirements are presented for each of the categories of Electronic Display System Devices: Network Server, Work-Center, Portable, and Rack-Mounted. The following requirements will be specified, as applicable:

3.2.2.1 Physical Requirements

Physical Requirements specifications (where applicable) are presented for each of the three types of Display Devices.

    a. Size

    b. Weight

    c. Design Life

    d. Health and Safety.

3.2.2.2 Performance Requirements

The following performance requirements are presented for each of the three types of Display Devices:

    a. Display Types

    b. Screen Characteristics

(1) Size
(2) Resolution
(3) Pixel Ratio
(4) View Angle
(5) Backlight
(6) Ambient Light
(7) Shades of Gray

c. Color Capability, Quantity, and Resolution

d. Processing Power

e. Memory Requirements

(1) Memory Types
(2) Secondary Storage
(3) Expansion Requirements

f. Self Tests

g. Hardware Reset Capabilities

h. Reliability, Availability, and Maintainability

i. Operating Configuration

j. EMI

k. I/O Requirements

3.2.2.3 Power Requirements

Power requirements are presented for each of the three types of Display Devices.

3.2.2.4 Interactive-Interface Requirements

Specifications for the interactive-interface requirements are presented for each of the three types of Display Devices. These requirements include:

a. Keyboard

b. Touch Screen

c. Cursor

d. Track-Ball

    e. Mouse

    f. Joy-Stick

3.2.2.5 Environmental Characteristics

Requirements for Environmental Characteristics are presented for each of the three types of Display Devices.
These requirements include:

    a. Operating temperature range

    b. Non-operating temperature range

    c. Humidity

    d. Ambient Air Pressure

    e. Electrostatic Discharge Sensitivity

    f. Operating Inclination

    g. Transportability

3.2.3 Electronic Display System Devices

3.2.3.1 The Network Server

3.2.3.1.1 Server Physical Requirements

Weight: < 60 lbs.

Size: 24" wide X 24" deep X 36" high.

3.2.3.1.2 Server Performance Requirements

Operating
Configuration: Stand alone or networked.

Electromagnetic
Interference (EMI):   The server shall not be susceptible to EMI or electromagnetic (EM) pulse effects, and shall conform to TEMPF requirements.

3.2.3.1.2.1 Server Display Requirements

The IETM System Server shall have a console with a display and a keyboard as specified below. All displays used on the server shall have the following characteristics:

Screen Type: Electroluminescent (EL), Liquid Crystal
                    Display (LCD), Cathode Ray Tube (CRT),
                    or Plasma.

Screen Size: 13 to 19-inch diagonal, CRT or
                    flat-panel.

Resolution: 640 x 480 pixels minimum.

Pixel Aspect Ratio: 1:1.

Backlight: Not required.

Viewing Angle: Readable to 30° deviation from
                    normal to the plane of the display.

Shades of Gray: A minimum of sixteen different shades of
                    gray shall be available if monochrome
                    display provided.

Color Capability: Optional as required in the contract. If
                    provided, a minimum of sixteen different
                    colors shall be available.

Color Resolution: Color capability shall meet or exceed
                    minimum display resolution requirements.

3.2.3.1.2.2 Server Processing Power

The server processor shall support multiuser/multitasking, networking, communications interfaces, and interoperability among delivery device configurations. The server shall have the ability to execute at a minimum of 8 million instructions per second (Mips).

3.2.3.1.2.3 Memory Requirement

3.2.3.1.2.3.1 Server Memory Types

The server configuration shall contain the following memory types and capacities:

Read-Only Memory (ROM): Sufficient for the resident Basic I/O
                        System (BIOS).

Random Access Memory
(RAM):   24 megabytes (Mbytes) minimum, to allow
                        for 30 simultaneous users.

3.2.3.1.2.3.2 Server Secondary Storage

Transfer Rate:	> 6 megabits (Mbits)/sec.
Average Seek Time:	< 100 milliseconds (msec).
Latency:	< 17 msec.
Shelf Life:	> 10 years.

3.2.3.1.2.4 Self Test

The server shall have a built-in, power-up self test. The capability to initiate the self test without cycling power is required. This test shall indicate if the hardware is faulty.

3.2.3.1.2.5 Server Hardware Reset

The server shall have a hardware reset capability to allow for manual restart of the system in the event of computer lockout (that is, when the server will not accept input). The reset shall not require power to the computer to be recycled.

3.2.3.1.2.6 Server Reliability and Maintainability

Availability:	A server shall have an availability rate of 95%.
Mean Time Between Failures (MTBF):	3000 hours, at 24° Centigrade, in accordance with MIL-HDBK-217.
Mean Time to Repair:	30 minutes.
Mean Time to Replace:	15 minutes for component module.
Preventive Maintenance Requirements:	Operator maintenance shall be limited to inspection for serviceability, routine cleaning, and replacement or recharging of batteries.
Parts Interchangeability:	Like parts or components shall be interchangeable as specified in MIL-E-5400.
Fault/Test Isolation:	Built-in self test shall isolate the replaceable component.
Special Tools/Test Equipment:	No special tools or test equipment shall be required.

3.2.3.1.3 Server Power Requirements

Power: 115 volts AC (vac), 60 hertz (Hz), 1
           phase; via plug-in cable to an external
           power source.

3.2.3.1.4 Server Interactive Interfaces

The following interactive interfaces are permitted:

Keyboard: Full alphanumeric keyboard, including
           separate QWERTY pad, cursor pad, number
           pad, and 12 function keys.

Touch Screen: 256 x 256 resolution minimum, operable
           with finger or stylus.

Cursor: Standard character-style cursor shall
           blink at a rate of 1/2 to 2 cycles per
           second (cps), dependent upon type of
           display.

Track Ball: Optional pointing device.

Mouse: Optional pointing device.

3.2.3.1.5 Server Expansion Requirement

The server shall be configured to allow future expansion of
functionality, memory size, and processing capabilities in a modular,
or "building-block," manner without compromising current capabilities.
There shall be sufficient internal space in the server to allow for
port expansions to support growth of the system.

3.2.3.1.6 Server Environmental Characteristics

The server and its components shall meet the following environmental
requirements:

Operating
Temperature Range: 0° to +50° Centigrade.

Non-Operating
Temperature Range: Less than -20° Centigrade and greater than
           +70° Centigrade .

Humidity: 10 to 90% relative humidity (RH)
           noncondensing.

Ambient Air Pressure: Sea level to 10,000 feet above mean sea level.

Electrostatic Discharge
Sensitivity: 10 kilovolts (kV) no errors; 17.5 kV no damage.

Operating
Inclination: The server shall operate at an inclination of 0° to 90°.

3.2.3.1.6.1 Transportability

The server shall be transportable, but need not be portable.

3.2.3.1.7 Backup Capability

The following backup capabilities are required:

a. The server shall have the ability to back up the software and data resident on the EDS, and

b. The server shall have the ability to create redundant copies of all resident information on an appropriate removable medium.

3.2.3.2   Work Center Device.

The WCD is an electronic device with sufficient information-handling ability to permit system support for every function of the EDS. Although the WCD will be an active node on the EDS network, it shall be capable of autonomous operation. It shall also be capable of downloading and uploading data to and from a PDD. The WCD shall be an existing high-performance personal computer.

3.2.3.2.1 Work Center Device Physical Requirements.

Weight: Not to exceed 35 pounds (per MIL-STD-1472). However, if the display panel is separable from the main unit, its weight shall not be included in the 35-pound limit.

Size: Not greater than 30 inches high x 18 inches wide x 18 inches deep.

3.2.3.2.2 Work Center Device Performance Requirements.

Operating
Configuration: Hard-wired, networked, or stand alone.

EMI: The WCD shall not be susceptible to EMI
                                   or EM pulse effects, and shall conform
                                   to TEMPEST requirements.

3.2.3.2.2.1 Work Center Device Display Requirements.

All displays used on the WCD shall have the following characteristics:

Screen Type: EL, LCD, CRT, or Plasma.

Screen Size: 15 to 19-inch diagonal, CRT or
                                   flat-panel.

Resolution: 640 x 480 pixels minimum.

Pixel Aspect Ratio: 1:1.

Backlight: Not required.

Viewing Angle: Readable to 30° deviation from
                                   normal to the plane of the display.

Shades of Gray: A minimum of sixteen different shades of
                                   gray shall be available.

Color Capability: *Optional.*

Color Quantity: A minimum of sixteen different colors
                                   shall be available.

Color Resolution: Color capability shall meet or exceed
                                   minimum display resolution requirements.

3.2.3.2.2.2 Work Center Device Processing Power.

The WCD processor shall support multitasking, networking, communications interfaces, connectivity, and interoperability among delivery device configurations. Each delivery device shall have the ability to execute at a minimum of 2 Mips for proper execution of the IETM presentation system.

3.2.3.2.2.3 Work Center Device Memory Requirement.

3.2.3.2.2.3.1   Work Center Device Memory Types.

Each WCD configuration shall contain the following memory types and capacities:

ROM: Sufficient for the resident BIOS.

RAM: 8 Mbytes minimum.

3.2.3.2.2.3.2   Work Center Device Secondary Storage.

    Transfer rate :   > 6 Mbits/sec.

    Average Seek time :   < 100 msec.

    Latency :   < 17 msec.

    Shelf life: > 10 years.

3.2.3.2.2.4 Self Test.

All WCDs shall have a built-in, power-up self test. The capability to
initiate the self test without cycling power is required. This test
shall indicate if the hardware is faulty.

3.2.3.2.2.5 Work Center Device Hardware Reset.

All WCDs shall have a hardware reset capability to allow for manual
restart of the system in the event of computer lockout. The reset
shall not require power to the WCD to be recycled.

3.2.3.2.2.6 Work Center Device Reliability And Maintainability.

Availability:	A WCD shall have an availability rate of 95%.
MTBF:	3000 hours, at 24° Centigrade, in accordance with MIL-HDBK-217.
Mean Time to Repair:	30 minutes.
Mean Time to Replace:	15 minutes for component module.
Preventive Maintenance Requirements:	Operator maintenance shall be limited to inspection for serviceability, routine cleaning, and replacement or recharging of batteries.
Parts Interchangeability:	Like parts or components shall be interchangeable as specified in MIL-E-5400.
Fault/Test Isolation:	Built-in self test shall isolate a replaceable component.
Special Tools/Test	

Equipment: No special tools or test equipment shall
                          be required.

3.2.3.2.3 Work Center Device Power Requirements.

Power: 115-vac, 60-Hz, 1 phase; via plug-in cable
                          to an external power source.

3.2.3.2.4 Work Center Device Interactive Interfaces.

The following interactive interfaces are permitted:

Keyboard: Full alphanumeric keyboard, including
                          separate QWERTY pad, cursor pad, number
                          pad, and 12 function keys.

Touch Screen: 256 x 256 resolution minimum, operable
                          with finger or stylus.

Cursor: Standard character-style cursor shall
                          blink at a rate of 1/2 to 2 cps,
                          dependent upon type of display.

Track Ball: Optional pointing device.

Mouse: Optional pointing device.

3.2.3.2.5 Work Center Device Expansion Requirement.

The WCD shall be configured to allow future expansion of
functionality, memory size, and processing capabilities in a modular
manner without compromising current capabilities. There shall be
sufficient internal space in the WCD to allow for port expansions to
support growth of the system.

3.2.3.2.6 Work Center Device Environmental Characteristics.

The WCD and its components shall meet the following environmental
requirements:

Operating Temperature
Range: 0° to +50° Centigrade.

Non-Operating
Temperature Range: Less than -20° Centigrade and greater
                          than +70° Centigrade.

Humidity: 10% to 90% RH noncondensing.

Ambient Air Pressure: Sea level to 10,000 feet above mean sea
                          level.

Electrostatic Discharge
Sensitivity: 10 kV no errors; 17.5 kV no damage.

Operating
Inclination: WCD shall operate at an inclination of
                                    0° to 90°.

3.2.3.2.7 Transportability.

The WCD shall be transportable, but need not be portable.

3.2.3.2.8 Backup Capability.

The WCD shall have the capability to back up resident software and
data.

3.2.3.3   Rack-Mounted EDD.

The rack-mounted EDD (RMD) is an integral component of test equipment
or other systems typically located in a protected repair shop
environment, although it may also be required to function in areas of
extreme heat or cold.

3.2.3.3.1 Rack-Mounted Device Physical Requirements.

Weight: Not to exceed 25 pounds.

Size: Not greater than 30 inches high x 18
                                    inches wide x 18 inches deep.

3.2.3.3.2 Rack-Mounted Device Performance Requirements.

Operating
Configuration: Terminal, networked, or stand alone.

EMI: The WCD shall not be susceptible to EMI
                                    or EM pulse effects, and shall conform
                                    to TEMPEST requirements.

3.2.3.3.2.1 Rack-Mounted Device Display Requirements.

The RMD display shall have the following characteristics:

Screen Type: Electroluminescent (EL), Liquid Crystal
                                    Display (LCD), Cathode Ray Tube (CRT),
                                    or Plasma.

Screen Size: Minimum 10-inch diagonal, flat-panel.

Resolution: 640 x 480 pixels minimum.

Pixel Aspect Ratio: 1:1.

Backlight: Not required.

Viewing Angle: Readable to 30° deviation from
normal to the plane of the display.

Shades of Gray: A minimum of sixteen different shades of
gray shall be available.

Color Capability: Optional.

Color Quantity: A minimum of sixteen different colors
shall be available.

Color Resolution: Color capability shall meet or exceed
minimum display resolution requirements.

3.2.3.3.2.2 Rack-Mounted Processing Power.

The RMD processor shall support multitasking, networking, communications interfaces, connectivity, and interoperability among delivery device configurations. Each delivery device shall have the ability to execute at a minimum of 2 Mips for proper execution of the IETM presentation system.

3.2.3.3.2.3 Rack-Mounted Device Memory Requirement.

3.2.3.3.2.3.1 Rack-Mounted Device Memory Types.

Each RMD configuration shall contain the following memory types and capacities:

ROM: Sufficient for the resident BIOS.

RAM: 8 Mbytes minimum.

3.2.3.3.2.3.2 Rack-Mounted Device Secondary Storage.

Transfer rate :   > 6 Mbits/sec.

Average Seek Time: < 100 msec.

Latency: < 17 msec.

Shelf Life: > 10 years.

3.2.3.3.2.4 Rack-Mounted Self Test.

All RMDs shall have a built-in, power-up self test. The capability to initiate the self test without cycling power is required. This test shall indicate if the hardware is faulty.

3.2.3.3.2.5 Rack-Mounted Device Hardware Reset.

All RMDs shall have a hardware reset capability to allow for manual restart of the system in the event of computer lockout. The reset shall not require power to the computer to be recycled.

3.2.3.3.2.6 Rack-Mounted Device Reliability And Maintainability.

Availability:	The RMD shall have an availability rate of 95%.
MTBF:	3000 hours, at 24° Centigrade, in accordance with MIL-HDBK-217.
Mean Time To Repair:	30 minutes.
Mean Time To Replace:	15 minutes for component module.
Preventive Maintenance Requirements:	Operator maintenance shall be limited to inspection for serviceability, routine cleaning, and replacement or recharging of batteries.
Parts Interchangeability:	Like parts or components shall be interchangeable, as specified in MIL-E-5400.
Fault/Test Isolation:	Built-in self test shall isolate a replaceable component.
Special Tools/Test Eq ipment:	No special tools or test equipment shall be required.

3.2.3.3.3 Rack-Mounted Device Power Requirements.

Power:	115-vac, 60-hz, 1 phase; via plug-in cable to an external power source.

3.2.3.3.4 Rack-Mounted Device Interactive Interfaces.

The following interactive interfaces are permitted:

Keyboard:	Full alphanumeric keyboard, including separate QWERTY pad, cursor pad, number pad, and 12 function keys.
Touch Screen:	256 x 256 resolution minimum, operable with finger or stylus.
Cursor:	Standard character-style cursor shall blink at a rate of 1/2 to 2 cycles per second, dependent upon type of display.
Track Ball:	Optional pointing device.
Mouse:	Optional pointing device.

3.2.3.3.5 Rack-Mounted Device Expansion Requirement.

The RMD shall be configured to allow future expansion of functionality, memory size, and processing capabilities in a modular manner without compromising current capabilities. There shall be sufficient internal space in the RMD to allow for port expansions to support growth of the system.

3.2.3.3.6 Rack-Mounted Device Environmental Characteristics.

The RMD and its components shall meet the following environmental requirements:

Operating Temperature Range:	0° to +50° Centigrade.
Non-Operating Temperature Range:	Less than -20° Centigrade and greater than +70° Centigrade .
Humidity:	10 to 90% RH noncondensing.
Ambient Air Pressure:	Sea level to 10,000 feet above mean sea level.
Electrostatic Discharge Sensitivity:	10 kV no errors; 17.5 kV no damage.
Operating Inclination:	The RMD shall operate at an inclination of 0° to 90°.

3.2.3.3.7 Transportability.

The RMD shall be transportable to the extent that the maintenance support console of which the RMD is an integral component is transportable. The RMD shall be capable of being used on, and transportable between, similar maintenance support console systems.

3.2.3.3.8 Backup Capability.

The RMD shall have the ability to back up resident software and data.

3.2.3.4 Portable Device Hardware Requirements.

The PDD shall utilize an internal source of electrical power, and shall have the ability to connect to an external power supply. Construction shall allow for the PDD to be used in an unprotected environment for extended periods of time. The PDD shall be equipped with a carrying strap or carrying case to facilitate portability. The PDD case shall be sufficiently sturdy to provide protection from accidental dropping from a height of one meter. The PDD shall be capable of withstanding general rough usage. The PDD shall be TEMPEST-hardened; however, it may be constructed in such a way that the unit could be inserted into a ruggedized case for use outside a shop or office area. The maximum weight requirement shall apply to the PDD and case as a singular unit.

3.2.3.4.1 Portable Device Physical Requirements.

Weight:	Less than 10 pounds, including batteries.
Size:	PDD shall not exceed 14" x 11" x 3".

3.2.3.4.2 Portable Device Performance Requirements.

Operating Configuration:	Networked or stand alone.
EMI:	The WCD shall not be susceptible to EMI or EM pulse effects, and shall conform to TEMPEST requirements.

3.2.3.4.2.1 Portable Device Display Requirements.

All displays used on the PDD shall have the following characteristics:

Screen Type:	EL, LCD, or Plasma.
Screen Size:	Minimum 9-inch diagonal, flat-panel.

Resolution:	640 x 480 pixels minimum.
Pixel Aspect Ratio:	1:1.
Backlight:	Required, Blue or Red.
Viewing Angle:	Readable to 30° deviation from normal to the plane of the display.
Shades of Gray:	A minimum of sixteen different shades of gray shall be available (Optional).
Color Capability:	Optional.
Color Quantity:	A minimum of sixteen different colors shall be available.
Color Resolution:	Color capability shall meet or exceed minimum display resolution requirements.

3.2.3.4.2.2 Portable Device Processing Power.

The PDD processor shall support multitasking, networking, communications interfaces, connectivity, and interoperability among delivery device configurations. Each delivery device shall have the ability to execute at a minimum of 2 Mips.

3.2.3.4.2.3 Portable Device Memory Requirement.

3.2.3.4.2.3.1 Portable Device Memory Types.

Each PDD configuration shall contain the following memory types and capacities:

ROM:	Sufficient for the resident BIOS.
RAM:	8 Mbytes minimum.

3.2.3.4.2.3.2 Portable Device Secondary Storage.

Transfer Rate:	> 6 Mbits/sec.
Average Seek Time:	< 100 msec.
Latency:	< 17 msec.
Shelf life:	> 10 years.

3.2.3.4.2.4 Self Test.

All PDDs shall have a built-in, power-up self test. The capability to initiate the self test without cycling power is required. This test shall indicate if the hardware is faulty.

3.2.3.4.2.5   Portable Device Hardware Reset.

All PDDs shall have a hardware reset capability to allow for manual restart of the system in the event of computer lockout. The reset shall not require power to the computer to be recycled.

3.2.3.4.2.6 Portable Device Reliability And Maintainability.

Availability:	A PDD shall have an availability rate of 95%.
MTBF:	3000 hours, at 24° Centigrade, in accordance with MIL-HDBK-217.
Mean Time To Repair:	30 minutes.
Mean Time To Replace:	15 minutes for component module.
Preventive Maintenance Requirements:	Operator maintenance shall be limited to inspection for serviceability, routine cleaning, and replacement or recharging of batteries.
Parts Interchangeability:	Like parts or components shall be interchangeable as specified in MIL-E-5400.
Fault/Test Isolation:	Built-in self test shall isolate a replaceable component.
Special Tools/Test Equipment:	No special tools or test equipment shall be required.

3.2.3.4.3 Portable Device Power Requirements.

Primary Power:	12 volt DC (vdc) rechargeable internal battery pack.
Auxiliary Power:	115-vac, 60 Hz via a plug-in external power cable. Auxiliary power shall be sufficient to recharge battery pack during on-line PDD operation. AC power transformer shall be an integral part of any external power cable; rectifier circuitry for converting AC to DC shall be internal to the PDD system.
Power Management:	The PDD shall also utilize power management techniques to minimize power drain of screen, disk drives, and other

high power consuming components when not
in use.

Battery Low Indicator:	An LED-type low battery voltage indicator shall be provided. The PDD shall be capable of operating for a minimum of 3 minutes after low battery indication, and prior to any loss of data.
Battery Operating Life:	The PDD shall be capable of operating at full power for a minimum of 4 hours before recharge.
Battery Replacement:	The batteries shall be easily replaceable without loss of data while the PDD is operating.

3.2.3.4.4 Portable Device Interactive Interfaces.

The following interactive interfaces are permitted:

Keyboard:	12-key keypad and cursor control. The keys shall have either blue or red backlighting.
Touch Screen:	256 x 256 resolution minimum, operable with finger or stylus.
Cursor:	Standard character-style cursor shall blink at a rate of 1/2 to 2 cycles per second, dependent upon type of display.
Touch Pad:	Option
Joy_Stick:	Option
Track Ball:	Not Permitted on PDD.
Mouse:	Not Permitted on PDD.

3.2.3.4.5 Portable Device Expansion Requirement.

The PDD shall be configured to allow future expansion of functionality, memory size, and processing capabilities in a modular manner without compromising current capabilities. There shall be

sufficient internal space in the PDD to allow for port expansions to support growth of the system.

3.2.3.4.6 Portable Device Environmental Characteristics.

The PDD and its components shall meet the environmental requirements for shipboard and shore-based equipment in accordance with MIL-E-16400. The PDD system shall be capable of operating as a stand-alone system in work centers at all maintenance levels, and in all organizational-level environments, such as flight line, hangar deck, flight deck, and field deployments. The operation of a PDD shall not cause ignition of ambient-explosive-gaseous mixtures with air, in accordance with MIL-STD-810, method 54, Procedure I.

Operating Temperature Range:	-20° to +70° Centigrade
Non-Operating Temperature Range:	-20° to +70° Centigrade
Humidity:	10% to 90% RH, noncondensing.
Blowing Rain:	4 inches per hour in a 35-knot wind.
Salt Fog:	Atomized 5% saline solution for 48 hours exposure as specified by MIL-E-16400.
Blowing Dust:	30 feet per second for 6 hours at operating temperature; 30 feet per second for 6 hours at 70° C and 15,000 feet mean sea level air pressure.
Ambient Air Pressure:	Sea level to 10,000 feet mean sea level.
Shock Resistance:	PDD system shall withstand Procedure 1. Shock in Method 516.2 of MIL-STD-810, or 3-inch corner drop, 5-g shock hazard, flat drop, and rail impact. Shall be able to withstand shock associated with repeated drops of one meter and tool impacts. Shall withstand the shock associated with transportation and use.
Oil, Chemicals, and Dirt:	Shall be resistant to fluid spills, and shall be immediately cleanable by wiping if contaminated with oil, grease, chemicals, or nuclear/biological/chemical (NBC) decontamination agents.
Fungus:	Shall withstand fungus growth typical of tropics, as specified by MIL-E-16400.

Operating
Inclination: PDD shall operate at an inclination of
                               zero to 90° with display screen flat or
                               vertical. When powered up and in use,
                               repeated rotation of the PDD about any
                               of its three axes at a rate of 45
                               degrees per second shall have no adverse
                               effect on its operation.

Health and Safety: MIL-STD-454, Requirement 1 shall apply.
                               Materials shall not create noxious fumes
                               under combustible conditions. The PDD
                               shall have no adverse explosive,
                               mechanical, or biological effects. For
                               safety considerations, no CRTs or
                               lithium batteries shall be used.

3.2.3.4.7 Transportability.

The PDD shall be fully transportable from one work location to
another. The PDD shall be transportable by standard commercial and
military land, sea, or air transport with minimum preparation and no
peculiar handling/packaging equipment. The PDD shall be provided with
a shoulder strap for carrying purposes.

3.2.4 General EDS Printer Devices.

Although the process of providing IETMs for electronic display is
designed to eliminate reliance on a paper medium, compatible printers
shall be available.

3.2.4.1 "B" Size Printer Hardware Requirements.

The EDS shall be supplemented by a printer capable of producing up to
"B" size drawings (11" x 17"). This permits generation of a paper
copy of some specific piece of an IETM which may be required by an
individual for performance of a specific task. This printer shall
print at near letter quality (NLQ). The printer shall be attached to
the server, and shall accept print jobs from the nodes on the LAN.

3.2.4.1.1 "B" Size Printer Physical Requirements.

Weight: < 120 pounds.

Size: Not greater than 24 inches high x 30
                               inches wide x 24 inches deep.

3.2.4.1.2 "B" Size Printer Performance Requirements.

Speed: > 20 pages per minute.

3.2.4.1.2.1 "B" Size Printer Memory Requirement.

RAM: >= 4 Mbytes.

3.2.4.1.2.2 "B" Size Printer Self Test.

The printer shall have a built-in, power-up self test. The capability to initiate the self test without cycling power is required. This test shall indicate if the hardware is faulty.

3.2.4.1.2.3 "B" Size Printer Hardware Reset.

The printer shall have a hardware reset capability to allow for manual restart in the event of a lockout.

3.2.4.1.2.4 "B" Size Printer Reliability and Maintainability.

Availability: The printer shall have an availability rate of 95%.

MTBF: 3000 hours, at 24° Centigrade, in accordance with MIL-HDBK-217.

Mean Time To Repair: 30 minutes.

Mean Time To Replace: 15 minutes for component module.

Preventive Maintenance
Requirements: Operator maintenance shall be limited to inspection for serviceability, routine cleaning, and replacement or recharging of batteries.

Parts
Interchangeability: Like parts or components shall be interchangeable as specified in MIL-E-5400.

Fault/Test Isolation: Built-in self test shall isolate replaceable component.

Special Tools/Test
Equipment: No special tools or test equipment shall be required.

3.2.4.1.2.5 "B" Size Printer Interactive Interfaces.

Type: Parallel.

3.2.4.1.3 "B" Size Printer Power Requirements.

Power: 115-vac, 60-hz, 1 phase; via plug-in
                              cable to an external power source.

3.2.4.1.4 "B" Size Printer Environmental Characteristics.

The printer and its components shall meet the environmental
requirements for shipboard and shore-based equipment in accordance
with MIL-E-16400. The printer shall be environmentally sealed to
prevent the invasion of dust or spilled fluids, and shall be capable
of being immediately cleaned by wiping. The following specific
requirements apply:

    Operating
    Temperature Range: +10° to +50° Centigrade.

    Ambient Air Pressure: Sea level to 10,000 feet mean sea level.

    Electrostatic Discharge
    Sensitivity: 10 kV no errors, 17.5 kV no damage.

3.2.4.1.5 Transportability.

The printer shall be transportable, but not necessarily portable.

3.2.4.2 EDD Printer Hardware Requirements.

3.2.4.2.1 EDD Printer Physical Requirements.

    Weight: < 5 pounds (including batteries if
                              applicable).

    Size: Not greater than 4 inches high x 12
                              inches wide x 8 inches deep.

3.2.4.2.2 EDD Printer Performance Req irements.

    Speed: >= 70 characters per second.

    Memory Requirements: Not applicable.

    Format Capabilities: Graphics-compatible.

3.2.4.2.2.1 EDD Printer Memory Requirement.

RAM: Not required.

3.2.4.2.2.2 EDD Printer Self Test.

The printer shall have a built-in, power-up self test. The capability to initiate the self test without cycling power is required. This test shall indicate if the hardware is faulty.

3.2.4.2.2.3 EDD Printer Hardware Reset.

The printer shall have a hardware reset capability to allow for manual restart in the event of a lockout.

3.2.4.2.2.4 EDD Printer Reliability And Maintainability.

Availability:	The printer shall have an availability rate of 95%.
MTBF:	3000 hours, at 24° Centigrade, in accordance with MIL-HDBK-217.
Mean Time To Repair:	30 minutes.
Mean Time To Replace:	15 minutes for component module.
Preventive Maintenance Requirements:	Operator maintenance shall be limited to inspection for serviceability, routine cleaning, and replacement or recharging of batteries.
Parts Interchangeability:	Like parts or components shall be interchangeable as specified in MIL-E-5400.
Fault/Test Isolation:	Built-in self test shall isolate replaceable component.
Special Tools/Test Equipment:	No special tools or test equipment shall be required.

3.2.4.2.2.5 EDD Printer Interactive Interfaces.

Type:	Parallel.

3.2.4.2.3 EDD Printer Power Requirements.

Power:	115-vac, 60-hz, 1 phase; via plug-in cable to an external power source.

                                         1 Jun 90:A

3.2.4.2.4 EDD Printer Environmental Characteristics.

The printer and its components shall meet the environmental requirements for shipboard and shore-based equipment in accordance with MIL-E-16400. The printer shall be environmentally sealed to prevent the invasion of dust or spilled fluids, and shall be capable of being immediately cleaned by wiping. The following specific requirements apply:

Operating
Temperature Range: +10° to +50° Centigrade.

Ambient Air Pressure: Sea level to 10,000 feet mean sea level.

Electrostatic Discharge
Sensitivity: 10 kV no errors, 17.5 kV no damage.

3.2.4.2.5 Transportability.

The printer shall be transportable, but not necessarily portable.

3.2.5 Transportation Cases, Packaging, and Handling.

Packing and handling shall be in accordance with MIL-P-9024.

3.2.6 Design and Construction.

3.2.6.1 Materials, Processes, and Parts.

All materials, processes, and parts used in the manufacture of the EDS shall adhere to good commercial practice and specific performance and quality parameters as delineated in the contract by specification and standard.

3.3 General User-Interaction Requirements

The following paragraphs describe the general requirements for user interaction with all types of displayed information. The EDS shall provide a common set of commands or input functions to the user for viewing, selection, manipulating, navigating, and accessing IETMs.

3.3.1 End-User Interactivity

3.3.1.1 User-Interaction Hardware

Normal output of the EDS is by screen display or, in special cases, by the generation of certain increments of TI in hard-copy form through the use of the supplemental printer. Capabilities for user

input to the EDS, to permit full exploitation of the Interactivity of the System, are discussed in this Section.

The user shall be able to interface with the EDS by means of the following devices and capabilities:

a. A fully functional alphanumeric keyboard with all required function keys;

b. A numeric, special-function keypad (integral to the PDD) that provides for cursor movement and selectable functions;

c. A mouse, track-ball, or joy-stick, the functions of which can be assumed by the keyboard should the mouse or track-ball become inoperative;

d. A touch-screen capability on all Devices which are capable of functioning as modules of the EDS.

3.3.1.2   Interactive Software

The management-interface functions of the EDS will be semi-transparent to the user, except when he must invoke a special function or provide information required by the EDS. Operation of the EDS shall not require the user to have any knowledge of programming. Display of information for the management functions may be in the form of dialogue queries or, in the case of information interchange with other computer systems or functional entities, direct display of information. Invocation of the management-interface functions shall be consistent with a general approach using adaptive, context-sensitive menus. However, in the case of restricted-access functions, a password routine or other access-control sequences shall be provided.

3.3.1.3   IETM Control Techniques

The EDS software shall provide a flexible control interface in order to fully utilize the opportunities provided by IETMs.

3.3.1.3.1 Text.

Effective utilization of IETMs requires flexibility in access and control of textual data. The various means of accessing this data are as follows:

a. Scrolling. The Scroll function shall provide the capability to reposition the text to view regions outside of the current display area.

   b. Expertise levels. The user shall be able to control the amount of detail provided through the selection of an expertise level (Novice or Expert). The novice level shall display significantly more detail than the expert level.

   c. Function Keys. Various function keys (fixed and variable) shall enable the user to access additional information.

   d. Menus. A set of adaptive, context-sensitive menus shall be used to guide the user through all possible options.

3.3.1.3.2 Graphics.

When graphics are required to support text, the graphic shall be displayed simultaneously with the appropriate text. Additional graphics shall be accessible through function keys or menus.

3.3.1.3.3 Warnings/Cautions/Notes.

Warnings/Cautions/Notes (W/C/N) shall be displayed automatically. The user shall have no control over the appearance of these messages.

3.3.1.3.4 Audio.

If Audio is utilized as an input or output during user interfacing, all functions must be duplicated by other input/output mechanisms. The user shall have control of the audio volume and the ability to turn off the audio.

3.3.1.3.5 Prompts.

Prompts are brief messages indicating the need for user interaction and must be utilized whenever user input is required.

3.3.2 User Input/Output Mechanisms

3.3.2.1 Input Capabilities

3.3.2.1.1 Alphanumeric Input

   All EDDs will be equipped with a full alphanumeric keyboard or other alphanumeric input mechanism.

3.3.2.1.2 Touch-Screen and Other Screen Position-Indicating Inputs

All IETM EDDs will have some provision for screen position-indication and selection (e.g. touch screen, mouse, trackball with selection button, etc.) in addition to the required cursor keys.

When display screens are equipped with touch-screen overlays, it must be possible to differentiate selection areas on the screen spaced at 1/2 inch.

This capability will be used for three purposes:

a. To select one of two or more choices as displayed by the screen for branching logic (calling one of two or more alternative frames of information), as in a Troubleshooting sequence.

b. To select the center for some special function, such as establishment of a Window or the center of a Zoom operation.

c. To touch a graphically displayed part as a technique for calling detailed IPB information to be used for ordering a part.

The EDS software may allow user input from a mouse or trackball device.

When any of the above devices are inoperative, the software shall be able to operate from directional cursor ("arrow") keys on the keyboard.

3.3.2.1.3 Data Buss Input

The EDS software shall have the capability of receiving and transmitting data through an external data bus (network). The software shall be able to support text, graphics, and audio input/output.

Any EDS node of the LAN must also:

a. Be capable of providing a full range of IETM and View-Package data to any other Display Device which acts as a node in the LAN;

b. Upload Technical Information to the File Server or other LAN node required in the normal processes of maintenance-action reporting and maintenance management.

c. Communicate with other Logistics-Support Information Systems connected to the LAN.

3.3.2.2 Display-Control Functions

Operation of the EDS shall not require the user to have any knowledge of programming. Display management functions of the EDS shall be transparent to the user. Information display shall be in the form of dialogues or queries, and shall be consistent with the general approach of using adaptive, context-sensitive menus.

3.3.2.2.1 Responsive Cursor Control.

Cursor control shall permit both fast movement and accurate placement. When the user must respond to a question, the software shall position the cursor in an appropriate box or response area.

3.3.2.2.2 Cursor Selection Area.

When selecting a displayed option, the minimum acceptable cursor activation area shall include the area of the displayed option label, plus a half-character border around the label.

3.3.2.2.3 Display Format Protection.

Cursor movement shall be confined to response areas for the current query.

3.3.2.2.4 Data Field Labels.

For each data field, an associated label shall be displayed to help users identify the data content. The appearance of labels shall be consistent throughout the software.

3.3.2.2.5 Windows.

Any IETM information shall be displayable in a window. The user shall be able to control the size of the window with the locating device. Windows may overlap and/or overlay each other.

The user may position an information window on top of the current display. The information window shall be treated as a second display surface. Only one display surface shall be active at any given time.

The information window shall be activated by a function key or button. The system shall retain the current display state.   Further interaction shall be conducted through the information window until the window is dismissed. When the information window is dismissed, the previous display shall be restored.

A capability for establishment of up to three Windows shall be incorporated into the EDS. Any material present in the TM shall be

capable of being displayed in a Window. Windows may overlap. The
Zoom function will not extend to information displayed in Windows, but
provision will be made to Scroll (pan) material in Windows.

3.3.2.2.6 Menus.

The style and display of menus shall be consistent throughout the
program. Menus and options shall be at the same location on each
screen, and, if possible, shall have the same label.

3.3.2.2.6.1   Menu Format.

The format of menu displays shall allow only one option per line.

3.3.2.2.6.2   Command Menu Options.

Menu options shall be phrased as commands to the computer, rather than
questions to the user.

3.3.2.2.6.3   Option Labels.

Each option shall be identified by a label. The option label shall
convey the meaning of the function it represents; option labels shall
not be arbitrary letter or number designations.

3.3.2.2.6.4   *Grouping of Menu Options.*

Menu options shall be formatted to collect logically related groups of
options.

3.3.2.2.6.5   Use of Hierarchical Menus.

A sequence of hierarchical menu selections shall be provided.

3.3.2.2.6.6   Design of Hierarchical Menus.

The hierarchical sequence shall provide a top-level group of options
to serve as a consistent starting point for user entries. The
sequence structure shall permit immediate user access to critical or
frequently selected options, and shall minimize the number of steps
required to complete the sequence.

3.3.2.2.6.7   Menu Usage.

The number of menus required to identify the information shall be
limited to the greatest extent possible. The style and display of
help information shall be consistent throughout the program. Menus
and options shall be at the same location on each screen and, if
possible, shall have the same label. For example, the combined use of
"Press any key to continue..." and "Enter Y to proceed" shall be

avoided. Standard phrases or words shall be used to help the user enter comments or select functions.

3.3.2.2.6.8   Menu Retracing.

The EDS shall always include control selections that allow the operator to return to the system menu or the previously displayed menu, regardless of the information being displayed.

3.3.2.2.7 Display of Text.

Conventional text shall be used to display procedural information. Text shall be displayed in mixed upper and lower case using conventional punctuation, spacing, sentences, and paragraphs. Words shall not be hyphenated between lines. Distinct paragraphs shall be separated by at least one blank line.

3.3.2.2.8 Display of Graphics.

Graphics shall be as simple as possible, reflecting only the degree of detail required to clearly convey the necessary information.

3.3.2.2.9 Graphics Description.

The EDS software shall utilize, manipulate, and compose data from the graphics data base according to the generative rules for each graphic. During the composition of the graphic, the software shall be responsible for composing the user display, including the addition of text (when necessary) or the composition of all text displays for the user.

3.3.2.2.9.1   Zoom (Enlarge/Reduce) Capability

A Zoom (scaling) capability must be provided for displayed material, permitting the user to change the size of displayed information from 1/4 to 4X regular size. Center of material chosen for Zoom will be selected by touch screen.

3.3.2.2.9.2   Pan Capability

A capability to pan the displayed material, right/left or up/down, will be provided by a cursor or special Pan function key. Panning motion will continue only so long as the key is depressed.

3.3.2.2.9.3   Highlighting

The Highlighting special function permits the display of a bright rectangle, reversed video, or a local flashing background around a

designated item of information selected by touch-screen or other position-locating device.

3.3.2.2.9.4   Animation

The Animation special function shall permit the sequential display of frames showing some kind of motion (e.g., sequential positions of a switch, dial, handle, etc.). At a point where Animation is available, the screen will so indicate.

3.3.3   Information Access and Control Functions

The total range of special functions (in addition to the display-control functions) available to a technician using the Work-Center Device shall be chosed from those described in MIL-M-GCSFUI Section 3.4. Choice of the list of special functions to be included in the EDS acquired under a given Contract will be as specified in the Contract.

These functions shall be exercised either by means of dedicated special-fur·tion keys labeled with the function involved, or by the use of ass_gned simple alphanumeric sequences. Keyboard layout and assignment of special-function calling sequences must be specifically approved by the Government. Some of these functions may be used together.

3.4 Software Considerations

3.4.1 Operating Environment

3.4.1.1 File Access Methods

File access must be provided in the operating environment. The file-access software must be compatible with the file-management software allowing remote file update.

3.4.1.2 Display-System Basic Operating Software

A standard, off-the-shelf operating system (e.g., UNIX, DOS, OS2) shall be used. This operating system shall be able to support a flexible and powerful data-base management system. The operating-system software shall conform to standard POSIX requirements (FIPS 151) unless otherwise specified in the Contract.

3.4.1.3 Network Interfaces

3.4.1.3.1 Internal EDS Interfaces

The network software shall provide for selective use of a Local Area Network. The network software shall enable a multiuser environment.

3.4.1.3.2 External EDS Interfaces

The EDS shall interface with those systems which contain data required for the integrated operation of the EDS, or which require data from the EDS. In addition, the network software shall provide the capability (1) of communicating with other local logistics-support information systems, which function as nodes on the network, and (2) of accumulating information to be submitted through such a network. These systems shall include, but not be limited to, the following:

    a. An automated debriefing module and its connection to required historical files and expert systems;

    b. A central service or DOD IETM library;

    c. A maintenance-data collection system;

    d. A supply system for parts-availability information and parts ordering.

3.4.1.4 File Management

The transfer of file data must be accomplished via the gateway and must permit the interchange of file data and the interchange of electronic mail and messaging.

3.4.1.5 Network Management

The EDS must include utilities that provide the capability to manage the communications directly amongst the EDS components and with external shipboard and shore-based equipment, Work Centers, intermediate maintenance shops, and all organizational maintenance levels, including flight lines, hangar decks, and flight decks. EDS external communication shall be in accordance with FIPS PUB 146 Government Open System Interconnection Profile (GOSIP).

3.4.1.6 Graphics Display Management

The EDS operating system must include software capable of carrying out all graphics-display commands contained in the IETM and View Packages, and of responding to user-input Display-Control functions (Section 3.3.2.2).

3.4.1.7 Data Security

The operating software will contain features which ensure protection of technical data, as specified in Section 3.1.3.6.

3.4.1.8 Special Input/Output Provisions

Special Input/Output provisions may be stipulated in the Contract; for example, the requirement for voice imprinting of each of the authored users.

3.4.1.9 Configuration Management

Operating software will be constructed so that required changes (additions of capabilities, or improvements in existing capabilities) can be easily incorporated and tracked. Before incorporation, all changes will be fully evaluated and tested in terms of the requirements of this Specification.

The Work-Center Device software shall contain a component (similar in function to the Government-developed test routine described in MIL-M-IETMQA, Appendix A) which, on command, cycles through the major Display-Device functions to indicate the status of IETM/Display Device availability. This software will test exhaustively the capability of a technician to retrieve the frames he needs for specific problems.

This software is intended to permit the technician to assess at any time the compatibility of a given IETM or View Package with his Electronic Display System. The routine will provide four menu-

selectable functions. It will assure that: (1) all calling sequences established by the author are valid and operable; (2) calling sequences implied by special-function keys are fully operable; (3) user-established calling sequences perform as indicated; (4) there are no "lost" (unreachable) frames in the entire body of the IETM. Prior to incorporating this routine into the system operating software, the logic of this Test Software shall be approved by the Government.

3.4.1.10 Built-In System-Test Software

The software shall contain a function which, on command, cycles through major software functions to evaluate the status of the EDS. This function shall exhaustively test the capability of the system to retrieve information needed for specific user procedures. The routine shall ensure that:

a. All links established by the author are valid and operable;

b. Sequences implied by special function keys are fully operable; and

c. There are no "lost" (unreachable) information entities/relationships in the body of IETMs.

Prior to incorporating this routine into the system operating software, the logic of this test software shall be approved by the Government.

3.4.2 System Applications

3.4.2.1 Maintenance Instructions

The EDS must present the procedural and descriptive information contained in an IETM or View Package as a task package such that all Technical Information is available logically. The EDS must present procedural information according to the current needs of the user. Access to the applicable descriptive information must be available during performance of procedures. The EDS must also switch among various applications.

Average time to perform a task must be available to the user. The EDS must have the capability to receive and display input concerning the actual supplies, tools, and support equipment used in the procedure.

3.4.2.2   External Reference Data

The EDS shall be capable of accessing external references as described in Section 3.4.1.3.2. All data to be externally referenced by an EDS must be interconnected with the EDS LAN.

3.4.2.3   Oversize Graphics Display and Manipulation

The user shall be able to view oversize graphics in one of the following two ways:

3.4.2.3.1 Primary Display Area Viewing

While in the primary display area, the user shall be able to zoom and pan around a graphic display to view the oversize graphic.

3.4.2.3.2 Subwindow Viewing of Oversize Graphics

The user may view a secondary window (subwindow) which shall be displayed in the upper right-hand corner of the primary display area. The entire graphic shall be reduced to be displayed in this subwindow. The user may view parts of the large graphic in the primary window. A rectangular dashed line shall outline the portion of the graphic currently being displayed in detail in the primary window.

3.4.2.4   Standard Forms Data Entry

The Form special function, followed by a brief alphanumeric sequence, calls one of the types of electronic "blank forms" which the technician must "fill out" as required to complete his maintenance Task. These might include forms such as:

a. Maintenance Action Reporting (MAR) form

b. Technical Manual Deficiency and Evaluation Reporting (TMDER) form (a form to report both errors and areas of incomprehensibility in the TM)

c. Part Ordering Form (POF)

Once the form is displayed, those blanks which the system has not already filled out automatically can be completed by insertion of required alphanumeric symbols with the alphanumeric keyboard.

3.4.2.5 On-Board or On-the-Job Training

3.4.2.5.1 On-Board or On-the-Job Weapon System Training

When the technician needs to train on a particular system, he will select the required IETM and perform training while in the work center.

3.4.2.5.2 Training Required for System Use

Individuals who use the EDS are expected to be trained prior to independent use of the system. However, the EDS shall be designed to minimize training requirements.

3.4.2.5.3 Training Required for System Administration

Individuals being trained for system administration shall receive training on the appropriate version of the software. They shall be made aware of all features of the EDS. It is the responsibility of the system administrator to train users on the use of EDS.

3.4.2.6 Parts Ordering

The parts-ordering function must provide the capability to access exploded parts data associated with a particular task or procedure. When active, the function must display (through a call to IPB data) a parts breakdown with:

(1) part name;
(2) part-number data;
(3) National Stock Number (NSN);
(4) Federal Supply Code for Manufacturers (FSCM);
(5) any other relevant designators associated with the task information previously displayed.

The parts-ordering function (accomplished through the Form special function) will be used with an order function to submit or prepare a requisition for replacement parts. When this has been completed, the parts-ordering function can be toggled off, and control of the EDS returned to the point where the user activated the parts-ordering function.

3.4.2.7 Help

The Help function shall display a help munu which shall provide for the following primary modes of embedded help:

(1) help information on the prime equipment being supported by the TI

(2) help information related to the particular information element being viewed at the time (context-sensitive help);

(3) help information on the EDS itself (i.e., How-to-Use-This-System information);

(4) a Help Look-Up Index.

3.4.2.7.1 Context-Sensitive Help

This mode of help provides specific instructions relating to the particular information element being viewed by the user.

3.4.2.7.2 Weapon System Help

This mode of the Help function must provide principles of operation, system descriptions, and other technical information describing the equipment.

3.4.2.7.2 How to Use the EDS

This mode of the Help function provides multiple levels of help on using the EDS. The first level of help must be a brief user instruction on how to proceed to the next logical display. The second level of help must be detailed description of the screen functions, layout, etc.

3.4.2.7.3 Help Look-Up Index

This mode of Help relates to operation of the EDS. The user shall be able to call up the EDS Help Index, which he enters alphabetically; e.g., Enter "c" for listing which includes "Cursor", or "m" for listing which includes "Mouse". This mode shall provide for simple (one-step) return to the user's position in the data base.

3.4.2.8 Troubleshooting Procedures

All three forms of the Display-Device types will be capable of interactively presenting fault-isolation procedures to permit a mainter ce technician to locate one or more faulty components. In genera the procedure (which is built into the relevant IETM or View Package) will lead the technician from a generalized report of equipment malfunction to one or more specific trouble symptoms (a process called Fault Verification). When a fault has been verified, and the appropriate trouble symptom entered, the Display Device provides the technician with one or more optimized test sequences which will permit him to identify the faulty components.

If specific fault symptoms are known at the outset of the maintenance effort, the technician may enter the Fault Isolation process directly, without performing Fault Verification.

3.4.2.8.1 Fault Verification

The technician must sequentially access (1) the Troubleshooting portion of the IETM, (2) the part of the Troubleshooting information relating to the Subsystem for which a malfunction has been reported, and (3) the part of that section dealing with the particular malfunction reported. Malfunction types will be cited as a result of System-operator (e.g., pilot) debriefing, in standard terms related to the weapon system; the Display Device will present a series of malfunction choices, one or more of which may be selected by touch-screen (e.g., "Power-Supply Malfunction", "Signal-Flow Problem", "Calibration Problem", "Display Problem"). For Fault Verification, the Display System shall be capable, when provided with the proper input information, of leading the technician through a logical sequence to one or more trouble symptoms (e.g., antenna fails to acquire target), expressed in technical System-related terms which then permit him to enter the detailed Fault-Isolation portion of the program.

3.4.2.8.2 Fault Isolation in Logic-Tree Form

The Display Device, with proper IETM input, interprets a trouble symptom input by the technician in terms of the weapon-system signal-flow logic (which has been provided by the IETM author) and identifies for the technician the most efficient next test of a sequence of tests (the results of which are reported to the EDS by the technician) which will ultimately lead him to identification of the faulty component. The system signal-dependency or logic-tree information which has been incorporated into the Troubleshooting IETM by the IETM author, is "transparent" to the user; he may, however, call the maintenance dependency charts for viewing if he desires.

3.4.2.8.3 Fault Isolation by Dynamic Fault Model

The EDS must also support near-term diagnostics methods such as symptom-based and expert system-driven fault modeling to the extent such processes have been incorporated into the IETM or View Package. The EDS must also support migration to future methods such as causal modeling and neural network approaches.

3.4.2.8.4 Entry into Corrective-Maintenance Sequences

Completion of the diagnostic routine must result in a smooth entry into the applicable repair (corrective-maintenance) procedures.

3.4.3 Special Utilities

3.4.3.1 Incorporation of Rapid-Action Change

The system software shall include a capability such that a message transmitted through a Rapid Action Change (RAC) system (designed to provide, rapidly, important change requirements for IETMs or View Packages before the IETM modification process is completed) can be keyed into the system by the Work-Center Chief, and commanded to override existing Technical Information for a given weapon system or prime equipment. This function is intended for use only in important cases (e.g., personnel or equipment safety). Where less important problems with a given IETM are noted by a technician, these can be handled via personalized records constructed through the notepad function of the Display Device.

3.4.3.2 TI Deficiency Reporting

The Display-System software must provide a capability for accumulation of organized IETM Deficiency Reports based on technician experience (e.g., errors, difficulty of comprehension) so that they can be displayed or transmitted to designated authority at specified intervals. To assist in this function, the Work-Center and Portable Display Devices will be equipped to collect automatically an information-use history during the course of a Maintenance Action to permit more complete analysis by the technician of a TM deficiency (e.g., analysis of the problem if a Troubleshooting procedure fails to isolate the faulty component). This information, also useful for the Maintenance Action Report (see Section 3.4.3.4), may be disposed of once used.

3.4.3.3 Supply-System Interfaces

The EDS must provide the capability to communicate directly with the logistic-support network of the ship or station (see Section 3 4.1.3) for such functions as:
   (1) Ordering a part.
   (2) Maintenance-Action Reporting.

To support these functions, the Display-System software will contain routines which accumulate requisite information during the course of a Maintenance Action (e.g., time required, nomenclature of faulty components, performance of Corrective Maintenance). The

Display Device, as appropriate, will open a desired communication link
(e.g., to check on the availability of a part), or will display the
required "forms" for these functions. The technician can "fill in"
the remaining information which the Device has not already abstracted
from the on-going maintenance process.

3.4.3.4 Maintenance Reporting and Maintenance Audit Trail

The Work-Center Device will also record an "audit trail" of
Maintenance Actions, both for maintenance-management review and for
accumulation of data needed for "filling out" the required
maintenance-action reporting forms (e.g., 2-kilo, VIDS/MAF) needed for
other utility functions.

Software shall include audit trails for logging transactions. The
reasons for an audit trail are as follows:

3.4.3.4.1 Data Recovery

A real-time audit trail captures maintenance data for later insertion
into the historical database.

3.4.3.4.2 Protection Against System Failure

When the user makes a data entry, the system shall record the
responses in an audit trail. This information can be used to restore
previously entered information in the event of a system failure.

3.4.3.5 Work-Center Maintenance Management

The EDS must be capable of supporting Work-Center maintenance-
management functions independent of or integrated with the mission
debrief application.

The EDS must provide an interface to the maintenance-management
system to provide information for purposes of:

    a. prime-equipment configuration;
    b. parts and equipment availability;
    c. failure-trend analyses;
    d. Work-Center technician scheduling;
    e. work status;
    f. any other management information used to support the Work-
       Center chief.

For example, when called, the System must be capable of
maintaining and displaying to Work-Center technicians all Planned-
Maintenance schedules (as well as procedures) for each system under

the control of a given Work Center, as well as daily assignments by the Work-Center chief of Troubleshooting and Corrective-Maintenance assignments. (For a given weapon system, Scheduled-Maintenance information may be provided in an IETM different from the IETM that provides the Troubleshooting and Corrective-Maintenance tasks, but will be made simultaneously available by the Library function of the Work-Center Electronic Display Device.)

3.4.4 Accommodation of Applications Software Modules

EDS software shall be designed to permit addition and integration of new applications modules in addition to those currently installed in the field, without the necessity for redesign of any other part of the operating System or other software. Integration of additional applications modules shall not affect the performance of existing software modules.

4. QUALITY ASSURANCE REQUIREMENTS

A procurement specification must provide for the QA of the delivered products. The Contractor should be required to establish a Quality Assurance program which will assure compliance of the delivered product with contract specifications. This plan should make it clear that the conduct of the QA Program is the responsibility of the Contractor. Such a QA program must reflect the requirements of MIL-Q-9858 or MIL-STD-2168 as appropriate. The Government reserves the right to request QA records for review, to conduct In-Process Audits, or to conduct independent reviews at any time during the production process.

5. PACKING AND PACKAGING

Packing and Packaging requirements should be required to be in accordance with MIL-P9024.

6. NOTES

APPENDIX   List of Acronyms and Definitions of Terms

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